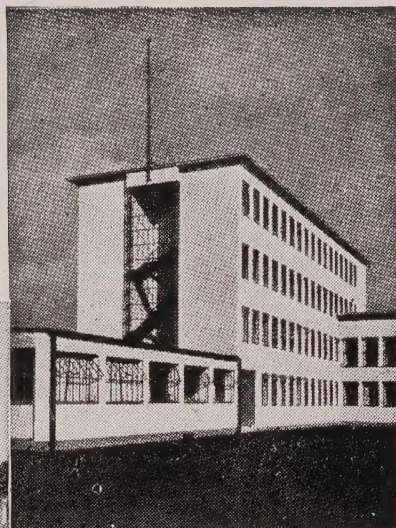
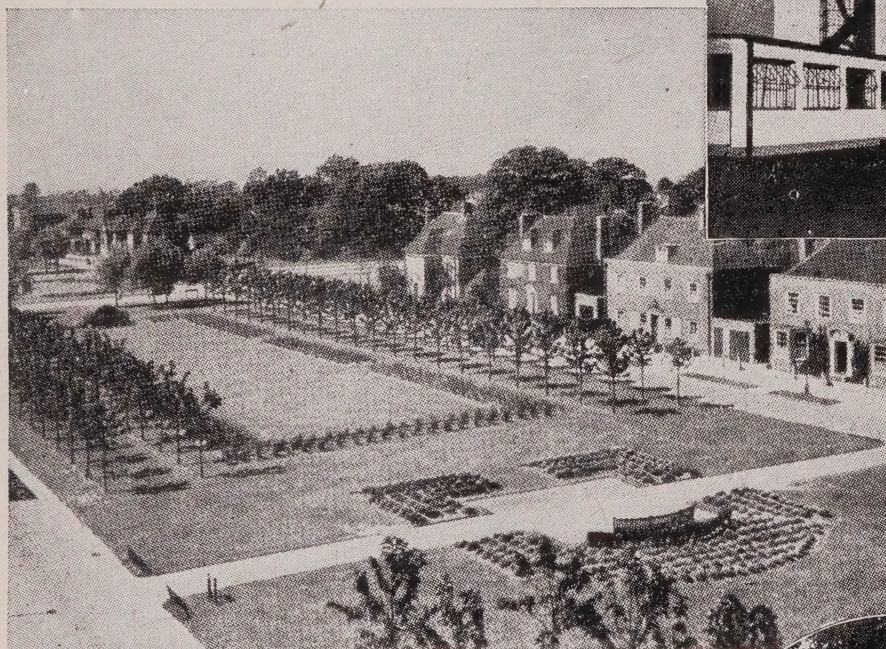


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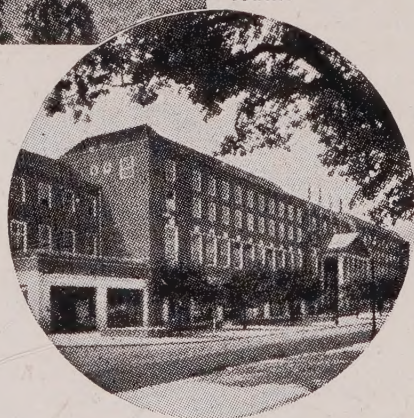
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SMOKELESS AIR

COMMENTARY

THE seriousness of the fuel position, coupled with the present freedom from heavy air attack, has at last resulted in a modification of the instructions made in 1940 for the production of extra smoke from industrial works. We have been very reticent, as we were asked to be, in discussing this peculiar and difficult problem, and no report has yet been made of the Society's representations to the Government in 1940 and again this year. Even now, normal conditions for the control of smoke have not been restored and it is still not possible for the Smoke and Sanitary Inspectors to use their special and intimate knowledge of local conditions for the purpose even of assisting the

fuel economy campaign by keeping a watchful eye on emissions revealing obvious fuel wastage. The new Ministry of Security circular (27/43) does however go part of the way when it urges that fuel should not be used for the purpose of making *extra* smoke. It implies, however, that some is still desirable for the creation of an hazy atmosphere.

WE believe, however, that the more enlightened industrial works are so much more concerned with fuel economy than with smoke production of any kind that the industrial smoke haze continues to be produced mainly from the less efficient concerns who are

wasting fuel as they have always done. The comment on the subject published in the *Fuel Efficiency News*, a printed bulletin of the Ministry of Fuel and Power, is an admirable summing up of the position (apart perhaps from the word "extra" in the second sentence):

"Industrial haze due to smoke from factories certainly makes it more difficult for enemy bombers to spot vital points in industrial areas. But it cannot be stressed too strongly that the fuel situation demands that extra fuel should not be used at present for this purpose.

"The maximum amount of *work* from the minimum amount of coal is more than a defensive measure: it is one of our strongest weapons of attack. We can and will beat off the enemy with it.

"Black smoke is a sign of fuel waste."

THE Society's programme and activities continue to develop at a quickening rate. Either with this issue of the *Journal*, or shortly afterwards, members will receive a new pamphlet, *Plan for Clean Air*, in which the case for smoke prevention and the means for carrying it out are presented in a brief and easily-read form. We hope to be able to supply quantities of this publication for distribution and all who are interested are invited to ask for particulars.

In view of the need to watch Government and other legislative proposals and also to prepare our own legislative schemes, particularly in relation to post-war planning, the Executive Committee has decided to set up a special advisory sub-committee which will hold its meetings in London. It has also decided to hold a General Meeting of the Society in London during the autumn, at which it is hoped that one of the principal items of business will be the election of a new President.

THE present direction of the Society's progress means that it may become necessary for us, even before the war is over, to return to our pre-war working position with offices in London. The present arrangement has resulted in valuable economies, but it cannot be continued for too long. One of the chief difficulties is to find suitable and adequate accommodation at a cost that will not take too much each year out of

slender resources that can be more fruitfully employed in other ways. If anyone can help us to secure good offices at a really reasonable rent, or if some generous friend could help us even more directly, we shall be very grateful. We predict a great deal of hard work for the Society in the next few years, and we shall do it all the better if we have plenty of elbow room and air at headquarters.

THE present reduced size of *Smokeless Air* means that we have to omit many things we should like to include, and severely to shorten others. We think, however, that readers will agree that the most interesting paper by Dr. Dobson and Dr. Meetham to the Royal Institution, in this issue, should have been published in full. The references to the Leicester survey, hitherto unpublished, are of particular interest, especially in the light they throw upon the now topical question of smokeless zones. Another paper of importance, which we hope to report at some length in our next issue, rather than deal with it too cursorily in this, is the recent Presidential Address to the Institution of Gas Engineers by E. V. Evans. In this is surveyed the present fuel position and the advantages, including a quantitative estimation of the reduction of air pollution, to be gained by possible developments in the utilisation of coal by chemical conversion.

A SUCCESSFUL conference of the West Riding of Yorkshire Regional Smoke Abatement Committee, held in Leeds on July 2nd, demonstrated the lively vigour and determination of this Committee. The meeting approved the report of the Executive Committee and the post-war planning proposals that have been made by the Executive. In the discussion many members showed that they are so anxious for decisive action that one is afraid of the Society appearing altogether too conservative by comparison. The Society's secretary had the opportunity of addressing the meeting and of outlining the Ten Year Plan and the urgent need to ensure that post-war housing does not mean five million new smoking chimneys. This latter point attracted press interest and it has been like the old days to

receive over fifty press cuttings reporting the paper. It confirms, if confirmation be needed, that now is the time to press home the fact that, if we are wise enough, all post-war building can be smokeless.

THE *Electrical Times* comments on this meeting and on the discussion about the Society's possible change of name, and envisages progress swifter and more certain than we have dared to hope for: "We hope the Society will change its name," it says, "as advocated some time ago, to the Pure Air Society, and that in 1954 it will dissolve, its task triumphantly accomplished, and its secretary generously pensioned." Viewing the matter quite impersonally, we feel that if final victory over our six hundred year-old enemy is achieved by 1954, the secretary and many others will well deserve to be generously pensioned.

The West Riding Committee, by the way, is also of the opinion that "smoke abatement" has had its day, and that the new idea of smoke abolition—of pure air, or smokeless air—should be given expression by a new name for the Society. The difficulty, of course, is that it will be much easier to discard the old name than to agree upon a wholly satisfactory new one.

LITTLE had been said or heard during the war of the serious hindrances to flying caused by the reduction of visibility due to smoke. When the war is over and civil aviation again comes to the fore the matter will again become one of importance—and then, too, we may learn something of what the R.A.F. thinks about it. In the meantime a telling piece of evidence comes from the U.S.A., quoted from *Heating and Ventilating* by our contemporary *Smoke* :—

"Birmingham, Ala.—A new reason for enforcing Birmingham's smoke abatement ordinance has presented itself—that of clearing the skies for the landing of big bombers at the plane modification plant of Betchel-McCone-Parsons Company. The city is threatened with the loss of part of this plant, unless the pall of smoke about the city is lifted, and already federal officials have held up a large appropriation for additional runways at the municipal airport . . . A recent survey showed that sixty per cent. of the city's smoke comes from private dwellings and apartment houses in which janitors and others tending the furnaces are not firing them properly. Flagrant violators of the law in this respect will be arrested."

At a recent Town Planning conference in Sheffield, James Law, Chief Smoke Inspector, made some good points about reconstruction and zoning in Sheffield and the opportunity of creating a smokeless central and light industrial area. Sheffield could have been one of the most beautiful cities in Britain, he said, and we now had the opportunity of making it much better than it was. Mr. Law's speech was followed by a "Bishop's Letter" on town-planning by the Bishop of Sheffield, Dr. L. S. Hunter, who said: "People who previously accepted our unplanned, dirty industrial towns, spreading anyhow, are having their eyes opened now . . . Replanning must begin with a determined effort to achieve a cleaner atmosphere by getting rid of the smoke nuisance."

Our "Smokeless Air" frontispiece photograph is of University City, Chicago—a superb example of planning for a special purpose without polluting the air.

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POST-WAR RAILWAY ELECTRIFICATION

THOSE of us who live in the South-Eastern corner of these islands are rather inclined to look upon our modern methods of travel with a somewhat blasé air. Dwellers in Kent, Surrey and Sussex have been so used to long distance electric trains for many years that they are taken as a matter of course and it is not generally realised that the Brighton all-electric route is already over ten years old. But of the total route mileage electrified lines in England are a comparatively small percentage.

What then is the reason for the apparent delay in the conversion of the remainder of the country's railways to electrical working—for it must surely seem to be worth while? In the first place there seems to be no doubt of the success of any conversion applied to suburban routes of reasonably frequent service and London has not been the only town where local lines have changed over to electricity. Main line conversion, on the other hand, has been generally held in the past to be in another category altogether. The absence of a general system of electric power in the "twenties" was undoubtedly a drawback to conversion of any kind but the Grid has remedied that. The lack of experience of main line electrical operation by British Railways was another drawback.

"Electric Traction" said the experts "is no good for main lines"—and this despite the fact that large numbers of main lines abroad, on the Continent, in India and in the Dominions had all been satisfactorily and profitably converted.

When the Southern Railway from 1933 onwards showed progressively by their electrification of line after line, to Brighton, to Worthing, to Eastbourne and Hastings and finally to Portsmouth that main line electrification was a paying proposition the public were told by the same experts that the routes in question were not strictly speaking "main lines." However, so far as railway electrification in Britain is concerned, it does not matter whether a railway is classed as suburban, inter-

urban or main line, the vital point is the density of traffic, actual or prospective.

The Weir Committee set up in 1931, which issued a report on main line electrification throughout the country, reached the conclusion that the average density of traffic of typical suburban lines was little greater than that carried on a considerable mileage of main lines. The importance of this conclusion is difficult to exaggerate. Electrification of much of Britain's main line system is justified therefore on the basis of existing traffic, ignoring the additional traffic that an electric service inevitably brings. It is even true to say that the general density of British railway traffic is distinctly greater than in many foreign countries where main line railway electrification has been extensively carried out with success.

It is not generally realised that the cost per mile of converting a main line is lower than for a suburban line while electricity also would be cheaper for a general electrification scheme than for a suburban one.

Financially, on a conservative basis the Weir Committee estimated that the return on complete electrification of our railway system would be in the neighbourhood of 6½ per cent. This, of course, was in 1931. Much has happened since then to vary the figure. Prices have risen for equipment and labour. Electricity, however, has not risen in price any more than solid fuel—probably less—and the post-war outlook depends naturally on pithead prices for coal. On the other hand considerable sums will have to be spent after the war on new rolling stock and overhauling track. The money to be expended in this way can well go towards complete conversion of all main lines and both inter-urban and suburban routes.

Fuel economy has ceased to be just a war-time campaign, having opened the eyes of the public to the waste which has taken place in every department of coal consumption. The subject of fuel economy is being gradually translated into plans for Fuel Conservation which will ensure the right use of the nation's fuel stored in the earth. One proposal



Town-planning demands clean new stations for old. Electrification makes this possible.

which has been made is that coal burning locomotives should be banished within a 20 mile zone from the centre of every large town, a first practical step in creating smokeless conditions on the railways. The complete conversion of the main lines to electrical operation would also contribute to a considerable extent to future fuel economy. The Weir Committee estimated that from 9-10 million tons of coal per annum would be saved in this way due mainly to the superior thermal efficiency of the modern power station over the steam locomotive. Such coal would be available for export and a substantial number of trucks carrying locomotive coal would be released for other use.

The smoke prevention possibilities which can be seen in wholesale conversion of the main lines to electrical working do not need any emphasis. The condition of some of our large termini and provincial centres cannot be tolerated after the war when stations are due to be rebuilt in future town planning schemes. Unless the steam locomotive can be made smokeless and its efficiency practically doubled the case for its continuance as a general

means of train hauling must inevitably fail. Electricity, as George Stephenson prophesied in 1847, must surely take its place.

Finally, there is the question of reliability. The modern electrified railway relies on electricity not only for its driving force but also for working its signals, lighting its stations and for heating, cooking and hot water on its trains. Failure at the source of the supply could cause widespread chaos yet with the passage of years reliability has increased. Even the stringent test of enemy action has failed to cause lasting harm. Britain's largest electrified railway system has been in the front line for nearly four years enduring nightly bombings for week after week. That such services could be maintained during the stress and strain of war is a tribute not only to the skill and enterprise of the railway staffs but also to the foresight of the Directors of the Southern Railway who authorised the conversion.

THE TEN YEAR PLAN

Executive Committee's Approval

AT a recent meeting of the Executive Committee it was agreed to adopt as part of the Society's policy the "Ten Year Plan" discussed in the last two issues of this journal. This is the first time there has been a considered scheme for the final abolition of smoke from this country, and its adoption marks an important development in the history of the movement. At the same time, however, it must be made clear that the plan so far exists only in outline and that much careful thought will be required to fill in the many details of practical application. And it must also be stressed that the plan must be subordinated in respect of urgency to the need for ensuring maximum smoke prevention in the new building of the post-war period.

The essence of the plan, to review it briefly, is that our towns and cities can be made completely smokeless within a period of ten years, by the establishment of a smokeless zone or zones which could be extended, stage by stage, so that at the end of the period the whole of the area concerned is smokeless. The starting point would be normally a smokeless central area, though in some cases new or rebuilt areas might provide the smokeless nucleus.

The main advantages of this method, compared with other possible means of attaining complete smokelessness, may be summed up as follows :

- (1) It is gradual. The rate of progress can be adapted to the flow of new supplies of smokeless mediums and appliances. Ten years is considered to be a generous maximum if a real effort is being made.
- (2) It is adaptable. It can be modified in its details in the light of local conditions and experience, and on account of other factors, local or general, that might arise during the ten year period.
- (3) It is selective. It need be applied, at least at first, only to the larger towns and conurbations. Rural districts and small isolated country towns, where there is no serious nuisance, can be dealt with later on by other means.
- (4) It is simple and certain. The only thing needed is to give local authorities power to make bye-laws defining the areas within which from a specified date smoke emission of any sort will be an offence, a "smoke nuisance" within the meaning of the Public Health Act, 1936. Any policeman in his ordinary round of duty in the area so defined would easily detect and bring to book an offender.

Having agreed to the Ten Year Plan in principle some reference should be made to the criticisms of it that were included in the symposium of readers' opinions in the last issue. At the same time it may be said that further criticisms are needed—it is in *Smokeless Air* that we must try to hammer out the plan in full.

First may be mentioned the contribution that appeared over the name of Sir David Milne-Watson, who suggested that it was premature to discuss any plan at all until "the principle of smoke abatement and the abolition of atmospheric pollution has been accepted by the Government." Surely, however, the acceptance of the principle of smoke abatement has been implied in every piece of legislation, and every Government Committee on the problem, starting as far back as 1819. And would the formal acceptance of the principle necessarily lead to suitable action? To collect irrefutable evidence and factual evidence, as Sir David suggests, for the purpose of convincing the Government that action must be taken without indicating what action *can* be taken, would of course be a valuable means for securing action if there was in fact any likelihood of new evidence of a kind so different in quality from that already available that it would revolutionise the present governmental attitude. But the dis-

covery of new evidence of such a character, from the nature of the case, is unfortunately most unlikely. (The most promising source of new evidence is in relation to the economic losses due to smoke, for which investigations need both time and money, and which it would be impossible to initiate during the war). We believe that there is a general agreement in all informed circles, including the Government, that it is desirable to end air pollution, and that what is lacking is the belief that it is practicable to do it.

Further, the case for the prevention of *new* smoke in post-war building and housing is strengthened by showing that the areas that can thus be created will not stand alone in their smokelessness, but are the first instalment of a general plan that will include existing premises of all kinds.

Mr. Richardson's criticism of the plan is from an entirely different viewpoint. He declares that we can only work for the time when a majority of the population will demand smoke abolition, and that it will not be democratic to do otherwise. This, he considers will require a vast educational campaign, the cost of which he compares with the cost of creating a sale for a new patent medicine. We can agree that we need to conduct an educational campaign far more extensive than anything that has been done up to now, but at the same time do not think that the position is the same as that which confronts the promoters of patent medicines. It is taking the restricted plebiscitary view of democracy to suggest that a reform such as smoke prevention must have the active demand of a majority of the community before anything can be done about it. We do not believe that it was found necessary in the case of other sanitary or housing reforms. And it must not be overlooked that the regulations envisaged do not interfere with the liberty of the individual to do what he likes in his own home provided that his actions do not impair the well-being of the rest of the community.

New Organisation Required

The third contribution to which reference may be made came from Dr. R. Lessing, and this is rather in the nature of new proposals than of criticism. It is suggested that an essential feature of any plan for the

abolition of smoke must be based upon the facts to be derived from a survey of the contributory sources of pollution. An examination of this suggestion has led the Executive Committee to add two new paragraphs to its memorandum on "Smoke Prevention in Relation to Initial Post-War Reconstruction," which included a reference to a voluntary scheme mentioned in an earlier issue for examining proposals for the installation of new fuel-burning plant. The two new paragraphs read as follows :—

- (1) Proposals were made in the original memorandum for the control of smoke, other than domestic, by requiring the approval of new plant and appliances before installation (see paragraphs 17-20, 25-31 and 71-77).

A procedure similar to that envisaged has been employed in a voluntary scheme by at least one of the larger cities. Plans for all new buildings deposited with the Surveyor's Department for approval are passed on to the Public Health Department for observations. This procedure has enabled the Senior Smoke Inspector and Factories Inspector to interview persons concerned as to : (a) suitability of proposed plant from a smoke abatement point of view ; (b) suitability of chimney stack height as compared with local surroundings ; and (c) the keeping of records and details of new plant. It is understood that this scheme has met with considerable success and that the view is held that it could with advantage be made obligatory.

- (2) The establishment of local or regional authorities for the approval of installations will require some form of national co-ordination to secure uniformity of practice and the dissemination of new information, particularly on technical advances. The control organisation required could appropriately concern itself with the task of surveying the sources of pollution with a view to establishing the responsibility of each type of source, both with regard to the quantity and nature of emission.

Such work, designed entirely from the preventative standpoint, could be associated with the promotion or co-ordination of researches designed to prevent such pollution, and with ensuring that the use of new methods and techniques resulting from research is made known to and encouraged by the authorities dealing with new installations and alterations.

The Next Stage

The Ten Year Plan is as yet only in its infancy and much work requires to be done in filling in the details and making it comprehensive. It is when we get down to detail that the snags and difficulties will appear. One factor of importance is that of railway smoke,

to which attention is drawn elsewhere in this issue, and there are many other special problems—such as, for example, nuisance arising from coke-ovens, colliery spoil banks, and certain industrial processes. And as air pollution in its broadest sense must be our concern it is time that attention must be given again to the difficult subject of fumes from road vehicles.

The translation of our general proposals into practice will necessarily involve proposals for legislation, both new and based on existing statutes. This, too, requires early and most careful consideration.

Once again, therefore, we appeal to our members and other readers to help forward this task by letting us have, whether for publication or not, their own views and suggestions.

News and Reviews

Coal Research

THE Report on "Coal Utilisation Research in Great Britain," issued by the Parliamentary and Scientific Committee, is a document of importance to all who are concerned with the planned development of a more efficient utilisation of our coal resources. The Report shows that considerable advances have been made in recent years: in 1913 only 15 per cent. of the useful energy in coal was utilised, while in 1938 the energy recovered had risen to 30 per cent.—a notable though far from final advance. The Report sees great scope for research in improving the standards of "climate control" in our homes, offices and factories in addition to research of many kinds in the industrial field.

The smoke problem is briefly discussed. "The seriousness of the problem," says the Report, "is not open to dispute. It adversely affects individual health, urban amenity and agricultural efficiency. Damage to and corrosion of stonework, metals, fabrics and other forms of property is extensive and entails considerable and continuous expense in maintenance and replace-

ment." And: "It is obviously important that the smoke nuisance should not be perpetuated by failure to use the most modern methods in post-war building and industrial re-equipment."

A number of recommendations are made, including the completion by the Government of the survey of our "actual and potential sources of energy and carbon compounds," with the addition to the present work of the National Coal Survey of all other sources of energy—petroleum, lignite, peat, wood and charcoal. Many items of industrial research are suggested, although it may be questioned whether the development of pulverised coal-fired locomotives is as desirable as the extension of railway electrification. The possibilities of district heating should be investigated, and "on the domestic side we want to see the smoke reducing coal fire, the provision of increasing supplies of smokeless fuels and continuous burning cookers which eliminate the labour of daily lighting and cleaning." Research expenditure on a far larger scale than has hitherto been considered is urged, and it is considered that such expenditure would

rapidly pay for itself in the economies and developments that would result.

The Parliamentary and Scientific Committee is an unofficial group of members of both Houses of Parliament and representatives of certain scientific and technical institutions, among which the Society is included.

C.P.R.E.

The Lancashire Branch of the Council for the Preservation of Rural England has issued a memorandum which was submitted to Lord Justice Scott's Committee on Land Utilisation in Rural Areas, on "The Future of the Lancashire Countryside." Some of Britain's most beautiful countryside is to be found in Lancashire, but so is some of that most spoiled and degraded by smoke and other consequences of industry and mal-development. It is therefore good to note that the C.P.R.E. has spoken strongly on this problem, and we cannot do better than record in full their statement:

"It is little use reconstructing the towns and building fine new houses, or endeavouring to restore urban dignity and beauty if we do nothing to minimise the evil of a smoke-polluted atmosphere. South Lancashire suffers terribly from this and *it may be considered the most serious cause of ugliness and discomfort throughout this area.* A smoke-laden atmosphere leads not only to dingy streets and blackened buildings, but to stunted vegetation, poverty-stricken pastures and low milk yields. Its evil effects on health by cutting out sunlight and by encouraging all forms of respiratory disease are well known, but appeared to be disregarded before the war by those responsible for new industrial and domestic buildings, as these only added to the evil. Smoke brings, too, the dense black fogs which bewilder and delay traffic and it lays a heavy burden on industry and home alike through the film of dirt laid on walls and fabrics. In itself, it means wastage of valuable by-products through inefficient combustion.

"Research should be sponsored by the State with a view to utilising our diminishing fuel resources with the greatest economy. All who use fuel should be encouraged in every way to burn the smokeless varieties or to instal modern smokeless stoves. The penalties for serious pollution by

industry should be more rigidly enforced on a regional basis. *The policy should be to reach a maximum fueling by means of gas, electricity, or smokeless fuel, both for industry and for private purposes, backed by compulsory powers.*"

The Post-War Home

The series of twelve lectures on "The Post-War Home" given to the Royal Society of Arts in 1941-42 has been published in book form (The Studio Ltd., pp. 120, 2s. 6d.). This is a volume that should be in the hands of all who are in any way concerned with the planning of our future homes, either with respect to structure or equipment. Every reader, too, will be interested from a purely personal point of view. With respect to smoke prevention the paper on "Lighting, Heating and Ventilation" by R. Fitzmaurice, Principal Scientific Officer of the Building Research Station, D.S.I.R., is of especial value and, with its discussion, well worth study. "Smoke abatement," says Mr. Fitzmaurice, "is an important national problem. It is difficult to assess in monetary terms the harm done to the community by smoke pollution . . . Ways and means of obtaining smokeless combustion are developing rapidly, and it is possible to look forward confidently to the ideal of completely smokeless heating of the home, even if the open fire is to be retained."

The main lines of improvement to be looked for in the future are summed up as (1) the betterment of building construction to ensure that heat wasted by conduction through the building fabric is reduced to a minimum. It is necessary to strike a careful balance between the possible saving in fuel and the additional cost, if any, of the building due to the introduction of better insulation. (2) The development of more efficient heating appliances and the education of the public to interest themselves in the efficiency of the appliances provided for them.

Fuel, Power and Transport

A paper read recently to the Institute of Export by W. Wakefield Adam, M.I.Mech.E., M.I.Ex., made a strong plea for the better utilisation of coal, the development of a national fuel policy, and the ending of the smoke nuisance. The electrification of our

railways was urged, with the use of the most modern practice—overhead contact lines, using a tension of 3,000 volts D.C., which, it was said, gives better results with much less capital expenditure. “Perhaps a good solution for improving the British railways,” continued Mr. Adam, “would be to electrify all main lines, certain branch lines, and suburban systems round large towns, and to use several thousands of Diesel rail cars over numerous branch lines where traffic is less intense. There are many places where a Diesel rail car weighing 22 tons

tare weight can handle the traffic being handled by steam trains weighing over 100 tons, consuming 70 pounds of coal per mile, or 12 tons for 400 miles, the Diesel rail car consuming 100 gallons of gas oil from coal for the same distance and service.

“The United States are using Diesel rail cars extensively and also Diesel electric trains, realising great economies in fuel and running expenses. On the continent in normal times France had about 2,000 rail cars, Italy over 1,000. In this country we have about 58, according to recent statistics.”

A NEW SMOKELESS FIRE

The “Benllech Hearth”

WE have recently had the opportunity of inspecting a new type of open fire designed especially for the burning of smokeless fuels. The special features of the fire are to some extent in line with other current trends of development, but taken as a whole the “Benllech Hearth” has a commendable individuality and appearance. It has been developed by John S. Auckland Young, R.E., A.R.I.B.A., B.A.(Hons)Arch., with the assistance, since he joined the Forces, of his father, J. W. Young, A.M.I.Mech.E., A.I.E.E., M.Inst.F.

The problem of domestic space heating with an open fire was approached from the point of view of control of air pressures within the room, so that air for combustion is not taken from the room, but, on the contrary, air for additional warming and ventilation can be supplied to the room. The hearth consists of a mild steel or cast iron construction below the hearth tiles and round the sides and rear of the fire-place. The base, or air inlet, is sunk below floor level and has three separate chambers, two of which are for ventilating air and are each fitted with a removable air filter of the shredded glass or sponge rubber type. The centre combustion air chamber has a removable ash pan and space for storing the fire tools,

with a hinged and balanced tile tray in the hearth proper giving easy access to all the chambers.

The centre chamber, in addition to supplying the primary air below the fire grid, supplies secondary air through a duct with openings at a fixed height above the fire bed. The chambers for ventilating air connect through ducts to the sides and back of the grate, where the air heater is located. From thence the hot air passes to a space round the base of the chimney and is discharged into the room through the tiled face of the fire-place.

The heater is calculated to produce enough heat to cause a flow of hot air to change the total air in the room three times per hour. This is achieved by increasing the heating area of the rear and side plates of the fire by welding webs on to these plates to give the necessary heating surface.

The air required both for combustion and for the convection heating, is drawn from beneath the floorboards, and for each purpose the amount can be adjusted by means of dampers. The air heating chambers are of course entirely separate from the combustion chamber and no products of combustion can enter into the filtered air flowing into the room.

The fire base is designed with a

special cast iron grid of round to square openings to allow the ash to drop through easily and to give sufficient air to burn coke or other smokeless fuel. A gas ignition and reviving ring is fitted below with the gas jets a half-inch clear of the openings. The secondary air inlets are designed to pass the necessary extra air required for complete combustion at the correct position for burning free carbon (if bituminous coal should be used) and for partially cooling the rear of the fire to preserve the life of the metal.

The sides and back of the fire itself are of firebrick, but the upper portion of this can be replaced by a cast iron water heater. This is constructed to the shape of the fire and has a removable plate at the back for cleaning. The connecting pipes are situated in the ventilating air chamber, where, with the lower tiles made removable, the joints are easily accessible, allowing the heater to be disconnected and removed for repairs or cleaning. At the rear and sides of the heater sheets of asbestos lagging are fitted as a heat insulator.

The only extra requirements of the Benllech Hearth affecting the appearance of a standard fire-place of any design is the tiled tray in the hearth proper and the air heater outlet, both of which can be fitted into the architecture of the fire surround.

The model inspected, with its absence of iron work and bars, had the pleasing appearance associated with such fires. The small charge of coke that was used was readily ignited and rapidly burned up into a brightly radiant fire. As the hearth became heated the flow of warm air issuing from the convector louver, coupled with the absence of draughts, noticeably increased the comfort of the room.

Further developments to improve efficiency are envisaged, and it is considered that the principles can be applied to any radiator such as a gas or electric fire.

It is not the policy of the Society to make exclusive recommendations of any type of appliance, but we are nevertheless glad to be able to give this short notice of the Benllech Hearth and to urge that its undoubted merits are investigated by those concerned with the use and development of smokeless fuels and appliances.

Octavia Hill and Smoke Prevention

TO most people the name of Octavia Hill conjures up visions of a housing reformer endowed with such wisdom and foresight, and so much in advance of her age that many of her ideals are only just being realised nearly eighty years after she began to formulate them. But she was more than that. She was also a vigorous advocate of smoke prevention. In the recently published biography (Octavia Hill by E. Moberly Bell, Constable, 1942) we read that in 1880 "a stay in Nuremberg opened her eyes to an English abuse which she felt must be combated on her return." This was her comment on the German town: "Trees grow among the houses, and children play round them, and clean, industrious women knit at their doors . . . and still these gardens for the people look reproach at me when I think of England; every tree and creeper and space of green grass in the town remind me of our unconsumed smoke, and how it poisons our plants, and dims the colour of all things for us." Having vowed herself to the struggle against smoke we find her on her return taking a leading part in the formation of a sub-committee of the Kyle Society to deal with smoke abatement. It was her idea to hold an exhibition to "show what could and should be done." That exhibition held in the early eighties was the first of many promoted by various agencies, the National Smoke Abatement Society and its predecessors amongst them—and yet the battle is not won. But Octavia Hill, far ahead of her own generation and of our own in this as in housing, saw clearly, so her biographer records, "how the problem must be approached: First public opinion must be aroused in the matter; people must desire cleaner air and be convinced that to secure it was practicable; then smokeless fuels and grates must be made available in a form both cheap and easy to use . . ." These opinions of sixty years ago might have been written yesterday. They might, as a matter of fact, have come out of a recent number of *Smokeless Air!*

M.F.

THE AIR WE BREATHE IN TOWN AND COUNTRY

By **Dr. G. M. B. Dobson, F.R.S.,**
and **Dr. A. R. Meetham**

*Being the substance of a Friday Evening Discourse at the Royal Institution
of Great Britain on 12th February, 1943*

ONE might think that the trouble of atmospheric pollution was a result of the industrialisation of Great Britain during the last 150 years. Those familiar with what John Evelyn wrote of London in 1661 will know that the trouble is no new one. However, no major attempt was made to obtain accurate records of the pollution in towns until about 1912 when a small committee under the chairmanship of Sir Napier Shaw designed suitable instruments and arranged for regular observations to be made which have gone on until the present day. Now it may be asked what good has been done by the very great amount of work which has been put into these observations. The answer is that without them there is no means of knowing whether the trouble is getting better or worse; whether big changes—for example the construction of the great power stations in London—have appreciably affected the conditions and whether legislation designed to reduce the evil, has in fact had any effect. It would have been of great interest if John Evelyn could have made even the simplest observations to show the intensity of pollution in his day.

The origin of pollution is partly industrial and partly domestic and it is one of the objects of any scientific investigation of the matter to determine how much is due to each of these causes. The pollution usually found in towns can be divided into three distinct classes :—(1) "Smoke" which consists of black carbonaceous matter formed by the imperfect combustion of fuel. This is mainly in the form of very small particles which float for a long time in the air only settling out very slowly. (2) "Ash" or grit which is thrown out with the flue gases and comes chiefly

from industrial plants where the velocity of the flue gases is high. Such ash consists of much larger particles than "smoke" and therefore settles relatively quickly out of the air in the immediate neighbourhood of the chimney discharging it. (3) Finally there are the corrosive sulphurous gases. Of these sulphur dioxide is generally the most important and comes from the sulphur always present in coal to the extent of from 1 per cent. to 4 per cent. These gases, of course, do not settle out at all and are removed by being dissolved by clouds and rain or by reacting with stonework and the like.

In the limited time available it is not possible to go into questions such as the damage caused by atmospheric pollution. The damage to buildings has been estimated at many millions of pounds per year while the cost to the housewife in extra washing and cleaning is certainly very great. The effect on health is very difficult to assess accurately but when the psychological effect of lack of sunlight is included, it must be very serious, and may well be the most important of all.

Let us first look at some of the instruments that have been designed to measure the amount of pollution. The instrument which has been longest in use is the Deposit Gauge. This consists of a large glass funnel into which rain and impurities fall, to be collected in a bottle below. The object is to measure the amount of pollution settling out of the atmosphere on to buildings, trees and the like. The deposit is collected once a month and weighed and analysed into its chemical constituents. The gauge is not one of the most useful instruments since it tends to collect material such as dust which is blown up by the wind.

In order to measure the amount of black polluting matter suspended in the air Dr. J. S. Owens designed the Automatic Filter, in which air is drawn through a filter paper which removes the dirt whose amount can be estimated from the blackness of the stain produced. The position of the filter paper is changed automatically once or twice an hour so that variations in pollution throughout the day are recorded. The fact that only black matter is shown on the filter paper is no great disadvantage since most of the dirt usually found in the air is black. It has been shown that the greater part of the dirt caught by the filter consists of carbonaceous matter floating as very small particles in the air and may be described as "smoke" in contrast to the larger inorganic particles of "ash" which quickly settle out of the air. A filter can be connected in the pipe supplying air to the apparatus for measuring sulphur dioxide apparatus and in this case the filter is changed once a day. A variation of this type of filter has been designed which can be weighed before and after exposure thus directly determining the weight of suspended matter in a given quantity of air.

Two instruments have been used to enable a count to be made of the number of particles floating in the air. The first, designed by Dr. Owens, drives a jet of damp air at a high speed against a glass plate when many of the particles are deposited on the glass though some of the smaller ones may escape. The second instrument, designed by Mr. H. L. Green, uses the principle of thermal precipitation by which dust in warm air is deposited on any cold object. In both instruments the particles are counted with the aid of a microscope and since the number of small particles that can be seen depends both on the illumination and on the magnification used, standard conditions must be employed if comparable results are to be obtained. If we wish to know the total number of particles present in the air down to the very smallest we must use the Aitken Dust Counter which uses the fact that if damp air is rapidly cooled by expansion, water droplets are condensed on each particle. The water drops fall out on to a polished metal surface and can be counted with the aid of a lens, but

since there are so many it is usually necessary to dilute the sample of dirty air with a large volume of clean air to get a reasonable number to count. The number of these particles varies greatly from some ten million per cubic inch in town air to a thousand or so in the cleanest country air. Some of the particles found in country air are produced naturally and are not due to human activities.

Several instruments have been designed to measure the amount of either daylight or ultra-violet light which is received. Some of these depend on the darkening of photographic paper and some depend on chemical actions such as the bleaching of dyes or the liberation of iodine from potassium iodide solution. They are usually exposed for 24 hours and give the total light received over that period.

Finally we come to the gaseous pollutions. The total acidity (mainly due to sulphur dioxide) is measured by passing a known quantity of air through water and titrating the resulting acid water after 24 hours. On the other hand we may determine what may be called activity of the sulphur gases by measuring the rate of sulphation of a standard surface of lead peroxide and in this way obtain a figure which will give an indication of the very much slower rate of attack of stonework, etc., by the sulphur gases. The latter apparatus has been found to be very useful since many sets can easily be exposed in different places—usually for a month—and then analysed.

Turning now to the results that have been obtained with these instruments we take first the Deposit Gauge. Of the total catch, part is soluble in water and part insoluble. Some of the insoluble matter is dust blown up by the wind and is often found to increase in dry weather. Much of the remainder comes from the two or three nearest industrial chimneys. The weight of soluble matter is very closely related to the rainfall and there is little doubt that the rain removes a considerable amount of the sulphur gases in the air. The sulphur dioxide is mainly caught by cloud droplets as they float in the air rather than by the rain falling through the air. This is indicated by the fact that the amount of sulphates, for example, deposited with the rain falls off much more slowly

outside a town than the amount of sulphur dioxide in the surface air. The sulphur dioxide at cloud level will be much more uniformly distributed than that in the lower air.

The results from the Automatic Filter may be used to show how the amount of smoke varies through the day. As might be expected, the air is cleanest in the early morning just before the first fires are lit for the day. A rapid increase of smoke then occurs, reaching a maximum in the middle of the morning. A shallow minimum during the afternoon is partly due to a reduction in the amount of smoke produced at this time and partly to the increased turbulence of the air in the middle of the day which removes some of the smoke from street level. A second maximum in the late afternoon, which may or may not exceed the morning maximum, is caused partly by cooking the evening meal and partly by the reduced turbulence at this time of day. A remarkable result that comes out of these observations is that even under conditions of very stagnant air which causes a thick smoke haze during the day, the air in the early morning is comparatively clean. Even a thick fog, which in the evening has become a "pea-souper" by picking up smoke, is found to be a nearly white fog, resembling a country fog, in the early hours of next morning; in other words yesterday's fog has been removed or deposited during the night and a new clean fog has taken its place only to become as dirty as its predecessor during the coming day.

Although most measurements of acidity in the air take a single sample running for 24 hours and so cannot show the diurnal variation, yet a few hourly measurements have been made. These show a maximum of acidity during the daytime but since the lighting of fires produces no extra acidity in the way that it produces extra smoke, we should not expect the morning maximum to be so marked. This is what the observations show to be the fact.

Both smoke and acidity show strong annual variations with a maximum in winter and minimum in summer. This is natural both because more fuel is burnt in winter than in summer and also because the greater turbulence in

summer will carry more smoke and acidity upwards.

The reduction of daylight—and particularly of ultra-violet light—near the centre of a large town by the smoke may be very great and the proportional reduction is much greater in winter than in summer, although there is more need for ultra-violet in winter. This is partly due to the greater amount of smoke in winter and partly to the fact that the more oblique rays of the sun must travel a longer path through the smoky air. On a bad day in winter in London, nine-tenths of the daylight is probably lost because of smoke alone.

In order to study the atmospheric pollution in the various towns and cities throughout the country, an organisation is in existence in which nearly sixty municipal authorities co-operate in making measurements of the pollution of the atmosphere within their respective towns, all the results being co-ordinated by a central committee under the Department of Scientific and Industrial Research, which carries out central services for this co-operative scheme. A large amount of information has been collected in this way during the last twenty-five years about the pollution at selected points in a number of cities. This information is very valuable in showing whether the pollution is getting better or worse, but it is usually not possible for any one city to run more than one or two stations and we should never in this way have found out much about the distribution of pollution in different parts of a town. Again since it is probable that the instruments set up in different towns will not be in comparable positions, we could say little about the general cleanness of one town as compared with another. What is perhaps more important still, is that we had little information about the "life history" of pollution after it left the chimney, and how it was removed from within the town, and how it was finally removed from the atmosphere. For this reason the Atmospheric Pollution Research Committee of the Department of Scientific and Industrial Research recommended that a thorough investigation should be undertaken into the distribution of pollution within one typical town. The city finally chosen was Leicester

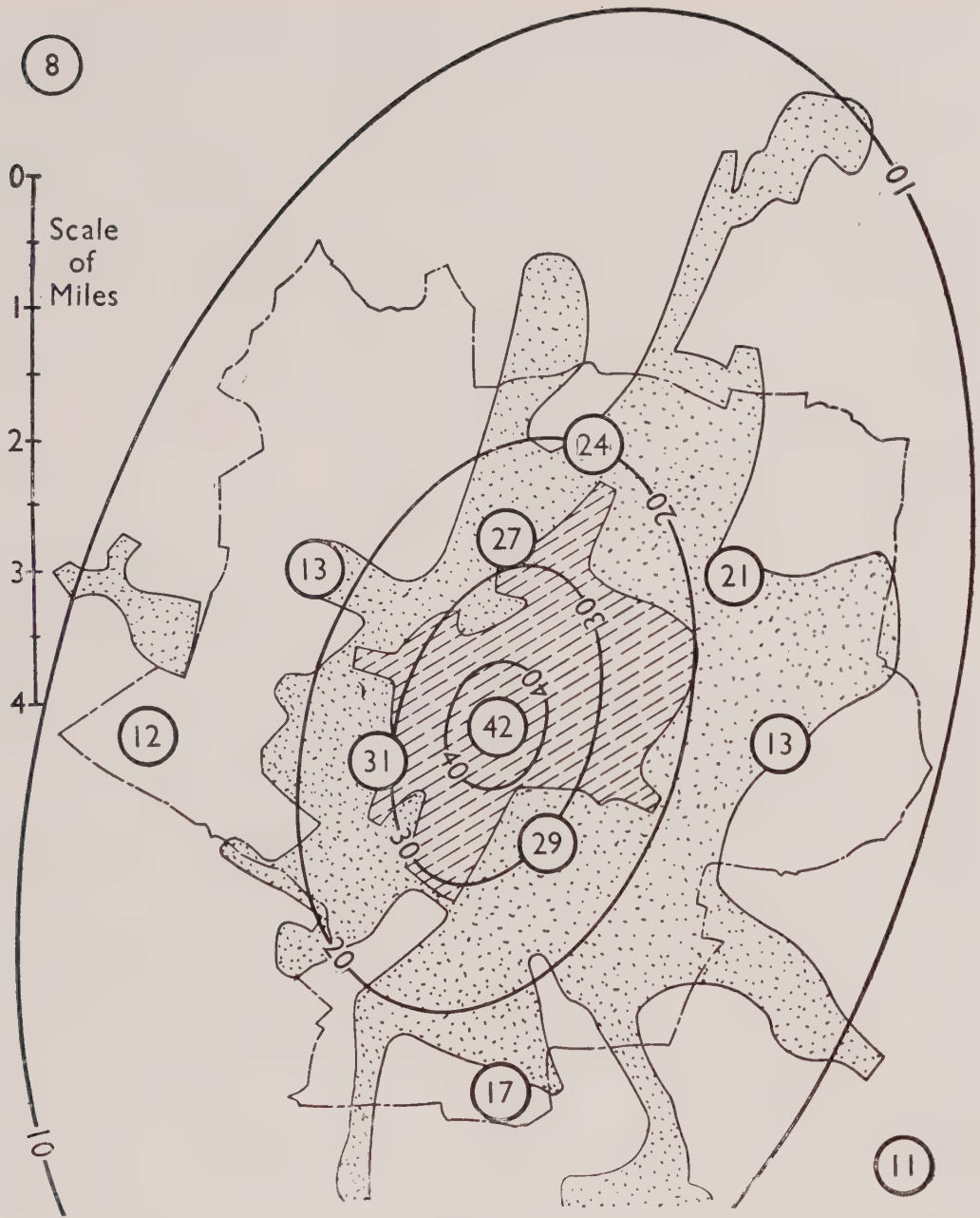


Figure 1

since it was a large industrial city and was fairly well removed from other large towns whose pollution might complicate the results. The authorities of the City of Leicester gave every possible assistance and two full years' observations were made there at a dozen different situations in the centre of the city, in the suburbs and in the country surrounding it. Observations of smoke, sulphur, acidity and daylight were made at all these sites. Later observations were made for a short time at a few other stations to clear up special points.

In figure 1 a map of Leicester is shown in which the built-up areas are

indicated by shading and the observing stations by circles containing a number. The average amount of smoke at each station is shown by the figure within the circle representing the station, and oval lines have been drawn as closely as possible from these values to indicate the general distribution of smoke over the city area. Curves for sulphur dioxide or acidity show distributions generally similar to that for smoke, except that there is a much higher maximum at the centre of the city. It is noteworthy that the maximum density of pollution coincides closely with the centre of the city.

A point of great interest is the effect

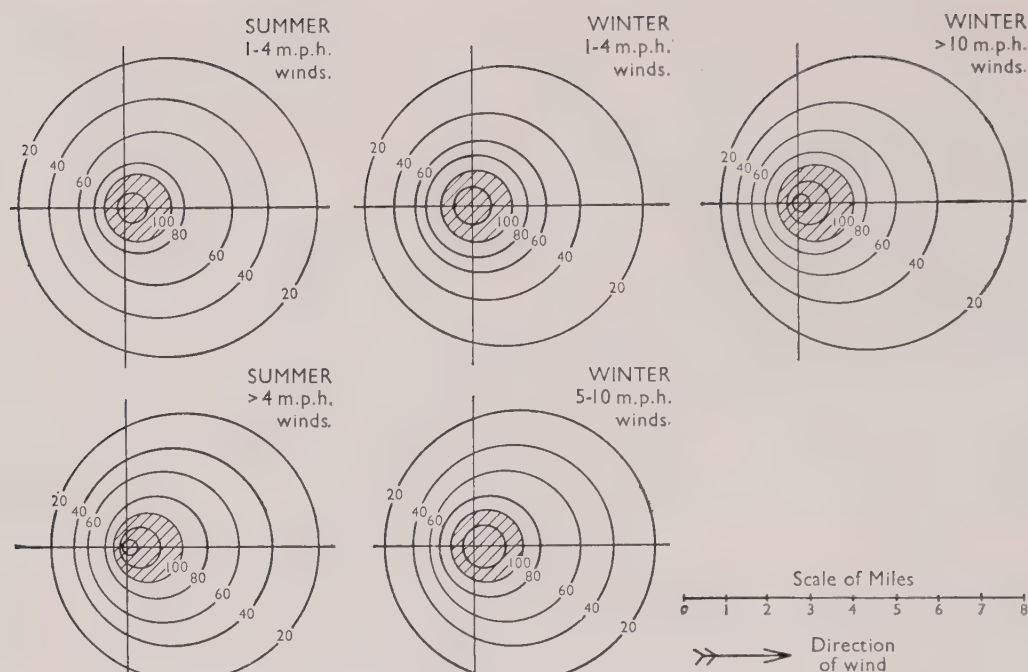


Figure 2

of wind on the distribution of pollution. Figure 2 shows the distribution of smoke for light and moderate winds in summer and for light, moderate and strong winds in winter, while the intersections of the straight lines indicate the centre of the city. At first it is very surprising that in all cases the highest pollution is found close to the centre of the city rather than some distance downwind from the centre and the general distribution—indicated by the circles—is remarkably little distorted by the wind, while the pollution added to the air by the large city of Leicester was difficult to detect above the general level of pollution in the surrounding country, only a few miles downwind from the centre of the city.

In an earlier research the number of particles found by the Owens dust counter were recorded at various distances downwind from the centre of Norwich. Although this work was less detailed than that at Leicester it again showed that even in strong winds the maximum number of particles was always found very close to the centre of the city and fell off rapidly downwind. It showed also that an increase of wind, by say three times, only resulted in a decrease of the pollution at the centre by about 30 per cent. At distances of more than 5 miles downwind the number of particles was nearly constant.

From these diagrams it is quite clear that somehow or other smoke is quickly

removed from the surface air where the measurements are made. If there were no removal of smoke, the concentration would steadily increase as the air passed across the city—more rapidly when passing over the centre of the city and more slowly as it passed over the outskirts—so that the densest pollution would be somewhere near the leeward edge of the city. It is possible that the removal of the smoke is affected in three ways, by diffusion sideways across the wind direction, by deposition onto the ground and by spreading upwards. Diffusion sideways could not account for the rapid fall in pollution at a distance downwind from the centre which is small compared with the width of the city. The deposit gauge gives no sign that deposition is sufficiently rapid to give the effect, and we are left to conclude that diffusion upwards into the upper air is the really important factor. Of course the smoke is finally carried away from the city area by the wind aloft but it seems that it is the removal of smoke from street level into the air a few hundred feet up that prevents smoke accumulating to a far greater extent than it usually does. That this is really the case is borne out by observations on days when the meteorological conditions are such that upward diffusion is stopped, for we find on these days that a dense smoke haze is quickly formed. The amount of upward diffusion is determined both

by the change of temperature of the air with height and by the wind. When there is a cool layer of air near the ground with a warmer layer above there is little vertical mixing of the air and these are the conditions when smoke accumulates excessively near the ground. A strong wind will cause a reduction of smokiness, but this is more because it increases the vertical mixing than because it carries smoke away horizontally. This accounts for the observed fact that the reduction in pollution at street level is much smaller than the relative increase in wind velocity.

We have shown that the smoke produced in towns is removed from the street level mainly by diffusion into the air overhead, but it must eventually be removed from the area of the town by being carried away by the wind, and it will go to pollute the air over the surrounding country. Since the pollution from towns is dispersed through a great depth of atmosphere by the time it has drifted many miles away, the actual concentration in surface air will be small and may be difficult to detect in the presence of quite small local sources of pollution. On the other hand the total mass of pollution through the whole thickness of the atmosphere may be great, so that it greatly affects the visibility and the colour of the sky. This makes the study of the pollution in districts far removed from its source rather difficult, and other methods may have to be used than those employed successfully in towns.

Up to the present time no thorough study of the spread of the smoke over the country has been made but it is easy to see its effects at great distances from towns. It has been estimated that during westerly winds a point some four miles to the east of Leicester receives about 30 per cent of its pollution from Leicester, about 25 per cent. from the Birmingham district which is 30 to 45 miles away, and 45 per cent. from elsewhere. North-easterly winds bring the least pollution to the Leicester district from outside since there are no large towns in that direction for many miles. At Oxford south-westerly and westerly winds generally give very good visibility but the smoke from the Midlands some 60 miles away produces much haze when the wind is north-

westerly or northerly. With moderate or light northerly winds the visibility may be quite good during the morning but about noon the Midland smoke can be seen arriving while the visibility decreases and the blue sky becomes whitish.

Turning to the effect of pollution on the light received in different parts of the city we find that in summer, when the amount of smoke is generally low, the reduction even at the centre of the city is small but in winter the decrease is very appreciable and in December the centre of a city may receive less than half that received outside it. The insidious effect of pollution on public health is partly due to this reduction of ultra-violet light, and may be the greatest evil of all.

It may be well at this point to say a few words about the effect of pollution on town fogs. It is probable that the *number* of fogs in a city is not increased above those in the surrounding country; indeed, as is well known, since there is a small increase in air temperature in towns above that of the country outside and since the rain will run off from roofs and streets much quicker than from open ground, one may expect the air in town to be slightly drier than that outside them. On the other hand the *character* of any fog which is formed will be greatly changed. Since there are so many more nuclei on which water droplets can form, the fog is likely to be noticeably more opaque and each droplet will catch some of the dirt floating in the air so that the fog will lose the white character it would have in the country and tend to become a black fog. The number of "pea-soup" fogs in London seems to have definitely become smaller in recent years but it is difficult to say exactly why this is so. Unfortunately the output of pollution does not seem to have decreased in the same ratio, but there was a substantial decrease in the five years following the last war.

One way in which we can get an estimate of the amount of domestic and industrial smoke is to measure the pollution on the different days of the week. On Saturday afternoon and Sunday a great proportion of the industrial fires including office heating will be out or be very low. On the other hand domestic fires will go on

as usual or may be slightly increased. It is found that there is a fall on Saturday afternoons and a marked drop on Sundays except in purely residential districts, the percentage drop varying between the residential and industrial parts of a town. On the average, the Sunday pollution in the centres of towns is about half to three-quarters of the week-day pollution, and as a very rough estimate we may take the smoke pollution to be two-thirds domestic and one-third industrial in origin.

There is a greater reduction of sulphur than of smoke at week-ends. This is because a greater proportion of smoke is produced from open fires in houses. In central Leicester on winter week-days, two-thirds of the sulphur is of domestic origin, whereas three-quarter of the smoke is of domestic origin. This all shows how much more wasteful of fuel we are in the home than in the office or factory. If domestic heating and cooking were done as economically as industrial heating and steam-raising we should use less coal in houses than industries, not more. These figures refer to peace-time, of course.

It may not be out of place finally to take a look at the problem with a view to the future and see what could reasonably be done to remove the evil. Of the three evils, "smoke," "ash" and "sulphur," it is reasonably easy to prevent the emission of ash from industrial plants without placing too great a financial burden on industry and one may hope that this will be made compulsory. The ash from domestic fires is probably too small to cause a serious nuisance.

The removal of "smoke" depends on burning fuel in a proper manner. There seems no reason why most industrial plants should make any great amount of smoke and even now the best plants are practically smokeless. Smoke means loss of fuel and it should be in the interest of the industries themselves to burn their fuel efficiently. A reduction in domestic smoke is likely to come about through the ever greater use of gas and electricity for cooking and heating while smokeless fuel may replace some raw coal. If district heating is widely adopted it should also help very much. Any method of increasing the efficiency of

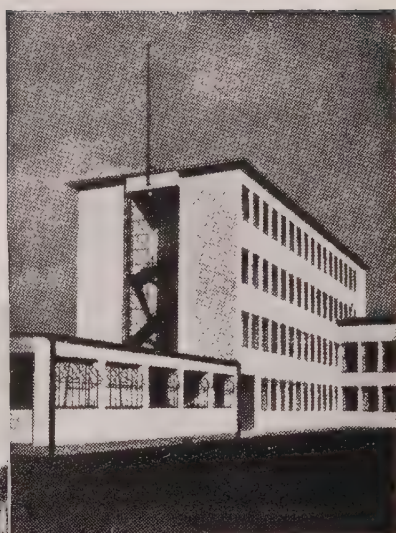
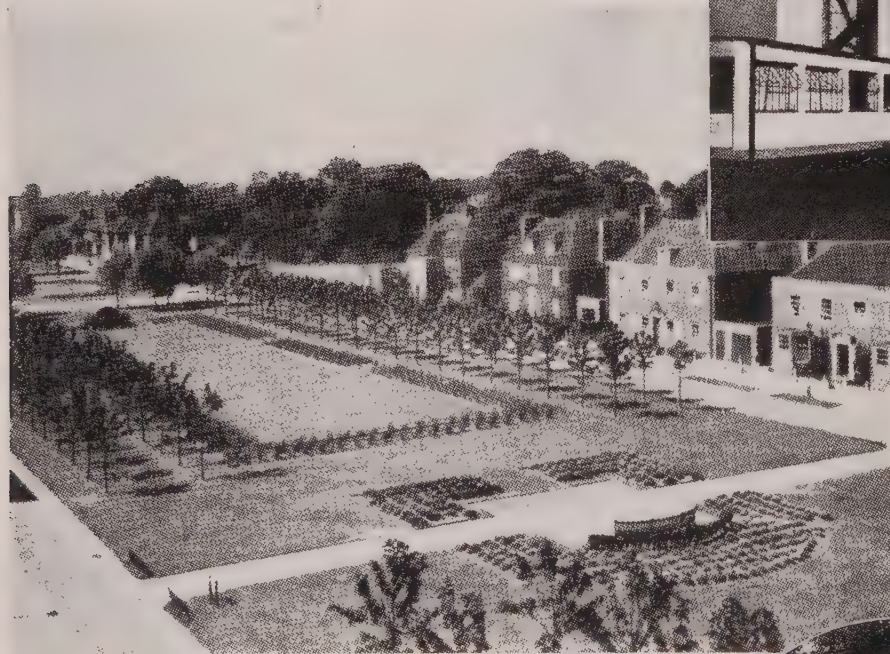
the open grate would improve matters, but short of abolishing open coal-fires altogether, the most effective reform would be to consume the smoke emitted during kindling and refuelling.

From time to time there have been suggestions that "smokeless zones" should be established in the centre of cities where no coal could be burnt in such a way as to produce smoke. The results of the detailed work at Leicester allow us to make a rough estimate of the effect. While such efforts are greatly to be encouraged, no striking effect is to be expected unless the smokeless zone is large owing to the smoke from the surroundings which will be carried into it.

To prevent the emission of sulphur dioxide may prove to be the greatest difficulty. However efficiently coal is burnt the amount of sulphur dioxide formed depends only on the weight of coal consumed and the sulphur content of the coal. Unless some means is provided for absorbing the sulphur before the gases are discharged into the air little improvement can be obtained, though washing the coal removes some of the sulphur. Some of the great electric power stations have means of absorbing the sulphur gases, but from by far the greatest amount of coal burnt all the sulphur dioxide formed is discharged into the atmosphere. There is some hope that, in the not too distant future, apparatus for absorbing sulphur gases may be practicable for much smaller plants, but it is perhaps too much to hope that such means could be generally adopted for the domestic fire. If communal or district heating were introduced on a wide scale the central plants might be fitted with sulphur absorbers. The use of coal gas (where almost all the sulphur is removed) or of electricity (provided sulphur absorbing plant is installed at the power stations) on a very much greater scale than at present, may be the final solution. It is greatly to be hoped that in planning the new Britain all practicable measures to reduce atmospheric pollution will be adopted.

(The authors acknowledge their indebtedness to the Department of Scientific and Industrial Research for permission to refer to unpublished results of the Survey of Atmospheric Pollution at Leicester.)

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SMOKELESS AIR

The Conference

As the report of the Conference is being published separately there is no need to do more than to comment upon it here. The General Meeting will be reported in the Annual Report to be published early in the new year. Its chief feature, the election of Will Melland as President of the Society is, we know, an event that will please all members, and particularly those who were with us in the early days. They will remember what the struggling League, as it was then, owed to the efforts, enthusiasm and generosity of Mr. Melland.

The Conference itself surprised us by the excellence of the attendance, which was greater than most of our pre-war gatherings. But the time was far too short for the ground to be

covered as those who spoke obviously wished it to be covered, with the result that the discussion was not able to concentrate upon the few but essential points on which guidance was hoped for. The case for smoke prevention is always liable to be spread too thinly over too wide a field, and to-day it is constructive concentration upon specific measures that is most needed. But, after all, it was the first conference since 1938.

Mixed Salad

Nevertheless, although the discussion was rather diffused it contained many points of general value and interest, and a number of useful items and ideas of real value. For example, to mention one or two, there was Dr. Foxwell's proposal for three Committees for the Society—Political, Pro-

paganda and Technical; the Rev. R. Burges's scheme for winning over and making use of the parsons; Mr. Margolis's information about Russia's reconstruction policy for "beatification"; Mrs. Alderson Horne's sound views on the open fire—and so on. Members will find the Proceedings of the Conference a readable and stimulating record. If it is not strictly the dish suggested by the programme of the conference it is all the same a good mixed salad.

Without Comment

We are in the peculiar position of having been requested to say nothing about a matter of considerable interest and importance, and we shall therefore, for the present, refrain from doing so. A paragraph on the subject has, however, been widely published in the daily press, and there can be no conceivable objection to this being quoted: "Industrial haze may prove a danger to our 'planes returning from raids, and the Air Ministry has asked for smoke abatement regulations to be introduced. The request is being sent to all local authorities by the Ministry of Fuel and Power."

The County of London Plan

The references to smoke abatement in the County of London Plan are both encouraging and disappointing. Encouraging because the seriousness of the problem is recognised and disappointing because the only ways of dealing with the situation that are discussed are partial improvements that will come incidentally as the result of general developments envisaged. There is, we regret, no conception of the planned series of measures that is to-day technically and administratively possible for the complete ending of London's smoke. We appreciate that it is easier, in a plan of the magnitude required for the creation of a new London, to avoid being too definite about the special problem of London's air. But the alternative is to acquiesce in the new London rising in an atmosphere little better than that which to-day makes it the world's dirtiest capital.

A Smoke Dodging Policy

We seem to have an unusual amount of criticising to do in these notes, and

now we must turn to "Memorandum B," issued by the Ministry of Town and Country Planning for the guidance of local authorities. This includes a suggestion that objectionable industries should be so sited that the prevailing wind does not carry their smoke, dust and fumes to residential areas. We are glad that the serious effects of smoke are so recognised, but sorry that this first reference to the problem from a Ministry in relation to post-war planning should be concerned only with what may be called evasive action—a method first proposed by John Evelyn nearly three hundred years ago. It is a very unsatisfactory approach to the problem. For one thing a prevailing wind is by no means an invariable wind, and a residential area must suffer some of the time from neighbouring sources of pollution. And, further, it is doubtful whether residential areas have any claim to be accorded such a privilege. The prevailing track of the pollution will have to be towards either other built-up areas or to agricultural land, and from an economic point of view in particular the consequences of pollution may well be more costly to industry, business activities, or to food-production, than they would be to residential districts. We hope that the Ministry will come to appreciate that the only logical way of dealing with the problem is to prevent the smoke. There is no reason (except perhaps a continued lack of determination on the part of the Government to tackle the problem) why any new industrial plant should emit smoke, fumes or dust to more than a negligible extent.

Planning the Gas Industry

The Gas Industry has submitted a Report to the Minister of Fuel and Power on "The Planning of the Gas Industry," which clearly indicates its future plans for organisation and structure to be on evolutionary lines. Two years research has gone into the drafting of the Report, which does not represent merely the findings of a group of experts, but, following democratic principles, has been circularised, discussed and amended in the light of comments from all sections of the Industry. The chief recommendations of the Report include the formation of a British Gas Association to

supersede various other national gas bodies now in existence and to assume their functions. Its Central Council would act as a "Parliament" for the Industry. Also proposed are methods of integration of undertakings throughout the country to provide a better service to the community after the war and to hasten the extension of gas into rural areas.

Furthermore, it puts forward a suggestion which this Society will wholeheartedly support — that the Ministry of Fuel and Power should appoint a National Fuel Advisory Council to facilitate the elimination of wasteful competition between the fuel industries, and to reinforce the spirit of constructive co-operation both in the interests of the national economy and of service to the individual fuel user.

One task for this Council, the Report points out, would be to give guidance in the matter of smoke prevention. "The abatement of smoke," says the Report, "is not only a social obligation. Its reduction—especially in the domestic grate and the smaller industrial installations—is of direct financial advantage owing to the conservation of fuel which results from the complete combustion necessary to eliminate smoke. In the case of the gas industry the production of smokeless fuels results in the recovery of valuable by-products. The imperative need for the reduction of smoke is one which concerns all health and housing authorities. The problem calls for the use of smokeless fuels, such as gas and coke, and the careful control of plant, both as to existing and future heating installations."

King Coalite

We were very interested to see that attractive "magazine of industry,"

Scope, devote its "Man of the Month" article to our friend Colonel W. A. Bristow. "Up North," says the article, "they call him King Coalite. That one lump of bituminous coal is burnt in this country in a total war is to Whiston Bristow nothing less than treachery to the nation's cause. Only a man (and there is only one man) who has been producing diesel oil, petrol, cresylic acid, tars, resins and a whole range of chemical products from coal for years, can know the despair of picking up a paper and reading that some wretched man has been fined £5 for taking his wife two miles to a cinema, wasting a few drops of petrol, while from the country's chimneys goes up in daily smoke tens of thousands of gallons of precious fuel, and knows he is powerless to stop the shameful waste."

The Netherlands

The attractive frontispiece photograph that heads these notes is of new housing in Amsterdam, and is reproduced by the kindness of the Netherlands Government. We hope that this corner remains as it was, dignified and serene, in spite of the ferocious destruction of so much by the Nazi invaders. Like us, when our friends return before very long to their country, they will have much to rebuild anew. Holland has for long been famous for the colour and loveliness of its towns and for the clarity of its atmosphere, and it would be a salutary thing for us to try to emulate their efforts when reconstruction starts in both our countries. It will be seen from the photograph that the block of flats is served by one main chimney, presumably from a central boiler house, and it is pretty certain that this is always as smokeless as it was when the photograph was taken.

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We ask every member to read
with care this frank analysis
of the Society's financial
position.

ATTACK:

AND THE MEANS FOR ATTACK

"I WOULD become a member of the Society if only it did more to arouse the public about the evils of smoke, but it seems to be in a comatose condition."

Such was the disturbing gist of a recent letter, received, fortunately for our morale, on the same day as a press cutting referring to the Society as "that active body." There is no real contradiction between the two points of view. We do not do anything like enough to arouse the public, and yet, in an all too modest way, we are decidedly active. Nobody is more aware, more painfully aware, of the many opportunities for excellent propaganda that slip by than those most closely concerned with the direction of the Society's efforts. The reason is the obvious one: simply a lack of money, and, because of that, a lack of all we need. Propaganda, like any other form of production, requires materials, services and time. Time means the man-hours available for the job. All these cost money.

Over the last fifteen years or so we have tested, on the small scale possible, many different forms of propaganda directed towards arousing the general public, always watching for and ready to follow up and develop any method that showed itself likely to be successful. Looking back at these efforts it is very difficult to see what the results have been, or indeed to see whether there have been any results at all. A ripple of interest here and there, perhaps; a few new members now and then, but little really tangible or encouraging. This is not because the case is bad, nor because the public is inherently impervious to the ideal of clean air, but simply because the means have been absurdly inadequate for a campaign on a scale sufficiently large or intensive to kindle public opinion to an idea that has to be considered before it can be

accepted. It is like trying to light a fire with a single match: the fuel may be warmed a little, but as soon as the match goes out it becomes cold again, and the heat of the match, intense though it is, fails entirely to spread through the mass of fuel. Intensity is not enough; there must be extensiveness and continuity if the effort is not to be completely wasted.

The conclusion is that to conduct a campaign directed towards the general public, to create, that is, a *mass* public opinion, we need what any new commercial product, or any national propaganda campaign needs—at least £50,000 a year, or possibly twice that amount to sell an idea rather than goods, for a period of several years. Without such sums available there seems to be little point, and much danger of wasting what little there is, in trying directly to create mass opinion.

So we must ask: can we hope to reach an income of, say, £100,000 a year? It is highly improbable that the smoke abatement movement, from the very nature of its case, can ever attain such an income. We cannot hope even to compete with the humane and charitable organisations that do derive comparatively large sums from the public, for these bodies base their appeals, directly or indirectly, on the powerful emotion of *pity*, and rally around them opinion that already exists. We, on the other hand, though we may be able to include a little sentiment in our appeal, have to depend upon considerations that do not drive the hand so deeply into the pocket, and which in any case have to be preceded by an intellectual judgment.

This analysis leads, it has to be admitted, to a rejection of attempts to achieve our aim by the direct creation of mass opinion. This does not mean that all forms of approach to the general public must be ignored, for some very

useful work can be done inexpensively and even sniping is often useful. But, it is suggested, such efforts must be incidental and must be subordinated to the strategy that is the only effective alternative to the impracticable frontal attack on public opinion.

What is this alternative strategy? Simply that what we have called mass opinion—the prevailing opinion of the general mass of fifty million people—is not the only one that counts. There is a wide, though relatively quite small field of what is called *informed opinion*. It is the minority who read and think, who have active social consciences, who do specialised and responsible jobs, who hold key posts, and who try, in their different ways, to mould the world into a better shape. They are the people, who, in fact, create and lead mass opinion—the teachers, town councillors, doctors, writers, politicians, trade unionists, architects, technologists, parsons, journalists, the leaders of the women's organisations, youth and education movements, and so on. To reach these people is a far easier task for a body such as ours. Not only are they organised, and not only are they more ready to understand and accept our case, but their numbers are so much smaller that it becomes possible to reach them all with the required intensity and continuity. And, what is most important, when they have been won, they will be able, in scores of diverse ways, to promote mass opinion far more effectively and certainly than can any single and limited source. To return to our fuel metaphor, informed opinion can be made the *kindling* that is needed—the kindling that can be set alight by the match and which, when it is burning well, will ignite the fuel.

This, then, it is suggested, should be our main task: to carry our campaign directly towards the hundred thousand, or half million, who constitute informed opinion. Looking back on our past efforts we see that we have in fact been devoting a good part of our energies to this very task. And it is that work, and not what has been done with mass opinion, that can be seen to have had a material and permanent effect. Our work in relation to local authorities, for instance, still has a long way to go, but the results so far are real and encouraging.

The concentration of our effort to

gain the support of informed opinion, instead of needing £100,000 a year to be worth while, could be done with the necessary vigour and on the requisite scale on one-tenth of that amount.

£10,000 a Year Essential

This sum is, we believe, within the bounds of possibility, and is indeed the target that the Society must energetically strive to reach. For many years we have been building up the prerequisites of such an income, and even though just before the war we had reached only the £1,200 mark, there were indications that good progress would soon be made. The war halted the drive that was then being planned, but the time is again approaching—if it has not already come—for making a new appeal. The prospects can be estimated from the rate of our past growth, which has been slow, only if it is appreciated that an increasing income is likely to increase at an *accelerating* pace.

This may seem over-optimistic, but the position may be explained thus: the support we receive is largely a function of our visible activity. The more we do the greater is the interest aroused, and the more widely known is our work. The field and prospects of new support are multiplied with every advance. Now with a small income of the order of £1,000 a year, most of the money has obviously to be spent on what may be called basic costs—the indispensable expenses of keeping the Society in being and good working order; minimum salaries, rent, essential publications and conferences, etc. Only a small proportion of the money is available for propaganda, distinct as such, and still less for winning new support. With an income of £1,000 perhaps £900 would have to be classed as basic expenses, but with £5,000 a year these would probably increase only to £2,500, so that the amount available for distinctive propaganda and appeals would actually increase from £100 to £2,500. What a difference that would make to the effectiveness of the Society! For one thing it would make it far easier to attract the further support required to reach the target of £10,000. And when that sum was available each contributor would know that the greater part of his money would be

utilised in vigorous activity of direct importance.

We believe that this factor is not generally recognised, but reflection will show how important it is. It is because of it that we are confident that once we can start the desired development moving it will go faster and faster, but the immediate task is to give the present income that first vigorous upwards push. And, it must be remembered, from the nature of the position we are in, we have to do this without being able to spend a large sum on appeals. We must appeal, to begin with, to those who already know and believe in the Society.

Just Suppose—

Suppose, for instance, every present member could increase his present subscription ten-fold? We should have our £10,000 a year, and a bit more, and our problem would be solved. We cannot, of course, ask for or hope for anything so remarkable, but . . . The idea is intriguing, and perhaps it could be brought down to a possibly more practicable level. *Suppose that those members who could afford to do so if they so wished, agreed to increase their subscriptions ten-fold or five-fold for a limited period—say three years.*

This would definitely give us the required impetus, and should enable us, in those three years, so to increase the scale of our activities that afterwards there would be no dropping back.

But all the same could we reasonably ask our members to increase the scale of their support even for so short a time? We are grateful for what they do now, and cannot afford to seem too grasping. And how many members could afford to pay more in any case?

The answer to this is, we think, enough to make the scheme successful.

There are, of course, many individual members whom it would not be fair to ask, although, maybe, there are some who could do something. But most of the affiliated and corporate members, whose support gives us the greater part of our present income, could surely, if they so wished, step up their contributions without difficulty. An important municipality, for example, that now subscribes a guinea a year could, it is not unreasonable to suggest, spare ten guineas; and a city that subscribes ten guineas now would agree that even £100 is, after all, a very minute fraction of what it will save when it gets rid of its smoke. Or a powerful corporate member might, if we may hint at the possibility, decide that a really fine gesture to the Society in the form of £500 a year for three years was a better investment than a present £50 a year for perhaps the next thirty years.

This last point, three years of thirty, is no rhetorical exaggeration. Ten thousand a year in the coming three years might well take smoke abatement further along the path of success than would a thousand for the next thirty.

The Society is working out its "Ten Year Plan." So why not a companion "Ten Fold Plan" to help to put it across—with a bang and not with a whimper?

Perhaps the discussion had better halt at this point. It is, we would point out, simply thinking in print, and by no means the prelude to an official plan. It is unorthodox, perhaps, in its approach to the problem and may be very faulty in its conclusions. Or it may be right. Which? We should like to know.

To be published shortly

- (1) Proceedings of the London Conference, 1943. (1/-)
 - (2) Annual Report, 1943. (2d.)
- (Both gratis to Members)

No Clean City and Plan for Clean Air still available in quantity

CHANGE OF ADDRESS:

Please note that the Society has now returned to its former address :
CHANDOS HOUSE, BUCKINGHAM GATE, WESTMINSTER, S.W.1

Telephone : ABBey 1359

The “Newton Committee” Report

Smoke Prevention Proposals in 1921

THE Report of the Departmental Committee on Smoke and Noxious Vapours Abatement, published in 1921, is now out of print, and will neither be available nor familiar to many whose interest in the subject is of more recent date. It may therefore be of value to give a brief survey of the Report, particularly as, coming during the period of reconstruction after the last war, it has a bearing upon many of the problems with which we are still confronted.

The Committee was originally appointed in 1914, following attempts to obtain new smoke abatement legislation, but was suspended on account of the war. In January, 1920, it was reconstituted by the Minister of Health, with Lord Newton as Chairman. In view of the great housing programme then starting it produced, within six months, an Interim Report that dealt mainly with the possibility of preventing or reducing domestic smoke.

The following extracts from this Interim Report show the general attitude of the Committee towards this aspect of the problem :

“We are satisfied that domestic smoke, which is produced by the burning of raw coal, causes serious danger to health and damage to property. Moreover the burning of raw coal is from the national point of view a wasteful proceeding. Not only are the valuable by-products of tar, oils, ammonia, sulphur and cyanogen compounds lost, but in addition, a large proportion of unconsumed fuel escapes in the form of soot owing to inefficient appliances . . . It has been established that methods are available for warming rooms, cooking and the provision of hot water, which produce little or no smoke, which are hygienic and economical, and which save labour. It appears to us that the great housing schemes, which are now being undertaken with the aid of the Government subsidy, afford a unique opportunity

for securing the adoption of these methods in the new houses.

“We repeat that, even if some small increase in expenditure were involved, that should not deter those concerned from acting on our recommendations. It has been agreed that for the sake of amenity only a small number of houses should be provided to the acre, and there can be no doubt that it is of equal national importance to avoid the production of smoke from domestic chimneys.”

Later, when the Final Report was published in 1921, the Committee, though it did not feel the time had come to propose legislation dealing with domestic smoke, said, plainly enough, that in dwelling-houses “the burning of raw coal is a dirty, wasteful and unscientific practice, and on grounds of economy, as well as of public health, it should be restricted as much as possible.”

The Committee therefore recommended with regard to domestic smoke :

“That the Central Housing Authority should decline to sanction any housing scheme submitted by a local authority or public utility society unless specific provision is made in the plans for the adoption of smokeless methods for supplying the required heat as suggested in our Interim Report. The only exception to this rule should be when the Central Authority are fully satisfied that the adoption of such methods is impracticable.”

The detailed recommendations in the Interim Report that are referred to were for the installation of gas or electric cookers in lieu of coal ranges ; the use of coke-fired boilers for hot water ; a central hot water supply, when practicable, in detached houses ; central heating in each house ; and “as far as practicable gas fires or hot water radiators (or electric radiators subject to the question of cost) should entirely supersede the old-fashioned open coal

fire, adequate means for proper ventilation being provided.”

Recognising the strong prejudice in many quarters in favour of an open coal fire, the Committee temporised by limiting its recommendation “to the extent, namely, that in none of the houses built with the assistance of the Government subsidy should more than one, or, in exceptional circumstances, two coal grates be installed.”

It must, however, be remembered that at this time smokeless fuels suitable for open fires were not developed as they are now, nor were there any grates specially designed for their combustion. Nevertheless, if the intentions of the Committee had been adopted with anything like determination, there is little doubt that notable and progressive advances could have been made during the last two decades.

But, alas, the possibilities of smoke prevention in dwelling houses were completely ignored.

New Buildings

Equally unfortunate was the loss of the chance of accomplishing the far easier task of preventing smoke in the heating of new buildings other than dwelling-houses. The Committee was quite definite in its recommendation :

“We consider, however, that the time has come when some measure of control over the heating arrangements of new buildings other than private dwelling-houses may usefully be exercised by local authorities. The sort of buildings which we have in mind are hotels, clubs, blocks of offices and the like, which, while contributing in no small measure to the pollution of the atmosphere of towns, admittedly cannot be adequately and economically heated by means of raw coal burnt in open grates. Central heating, or central heating combined with some supplementary form of heating, such as gas or electric fires, is probably the most suitable and economical method of effectively heating such buildings.

“We, therefore, recommend that local authorities should be empowered to make byelaws requiring the provision of smokeless heating arrangements in new buildings other than private dwelling houses.”

Industrial Smoke

The consideration of industrial smoke led to proposals for strengthening the existing law, so that the manufacturer

or user of plant should be under the general legal obligation of using the best practicable means for avoiding the pollution of the air, and that the Minister of Health should be empowered to fix standards which, when exceeded, would place the onus of proof that the manufacturer was using the best practicable means upon the manufacturer. There were other proposals for the administration of the law, some of which were duly embodied in the Public Health (Smoke Abatement) Act, 1926.

The procedure now being discussed, requiring proposed installations to be approved by a competent authority, was not considered, although it is interesting to note that in an appendix dealing with conditions in Germany (which was visited by two members of the Committee) it is stated that :

“ . . . Under the ‘Gewerbeordnung’ anybody wishing to instal a boiler or furnace must submit full particulars to the Police Authorities. The plans are examined by technical experts from the point of view of safety and smokelessness, and the authorities insist on whatever modifications they consider necessary or desirable.”

Conclusions

The findings of the Committee with respect to waste and damage caused by smoke have frequently been quoted (see for instance extracts in *The Case Against Smoke* and *No Clean City*) and perhaps do not need reprinting here. The summing up however, is a quotable and eminently direct statement :

“We have received considerable evidence to show that the nuisance is very real and widespread. We think that by this time it should be regarded as an axiom that an impure atmosphere is highly deleterious to health and property, that it is indicative of wasted fuel and energy, and that every practicable step should be taken to prevent it.”

Finally, the general conclusions of the Committee are of interest :

“The obvious conclusion to be drawn from our inquiry is that the prevalence of smoke pollution in this country is mainly due to the indiscriminate and wasteful use of raw coal for all purposes, whether industrial or domestic, and to the lax administration of the law by the responsible authorities . . . We have been struck by the fact that, more especially in the large cities, there is a strong body of

The Society's New Officers



Will Melland
President



Sir Lawrence Chubb
Hon. Treasurer

educated opinion which is extremely dissatisfied with present conditions, and would welcome more drastic action. The marked improvement in the atmosphere of London and other large towns during the recent coal stoppage has, we believe, intensified this desire for reform. On the other hand, it is an undoubted fact that the great majority of the public have never given any thought to the question of smoke prevention. Residents in industrial districts who have grown up and passed their lives in surroundings which occasionally appear to be almost intolerable, are found to acquiesce in a state of things which they believe to be unavoidable. Side by side with this attitude of indifference or resignation there still exists unfortunately, a widespread delusion that the presence of smoke implies prosperity, and that the blacker and grimmer a district the more flourishing are its circumstances. This attitude of indifference is reflected in the apathy of the great majority of local authorities throughout the country, who, as we point out, have failed to do their duty. But perhaps the chief

factor in the failure to deal with the smoke evil has been the inaction of the Central Authority. No Government has, for many years, taken any action with the exception of appointing Committees, whose labours have led to little or no result. Smoke and air pollution are, in our opinion, a national question, and we consider that it is useless to expect that it will be adequately dealt with by local authorities unless they are subject, when necessary, to the stimulus of Government."

To-day, twenty years later, we find that much of this is still true. Educated opinion is undoubtedly stronger than it was, but the great majority of the public are still largely unconscious of the question. The delusion that smoke implies prosperity is, we believe, now nearly dead, and the present war, with its demands for fuel economy, has done much to finish it off.

"The chief factor in the failure to deal with the smoke evil has been the inaction of the Central Authority. No Government has, for many years, taken any action with the exception of appointing Committees . . ." How prophetic a statement!

DAVID ADAMS

WE have to record, with regret, the death of Alderman David Adams, J.P., M.P. Mr. Adams was for many years a valued member of the Society's Executive Committee, and was Chairman of the Northumberland and Durham Regional Smoke Abatement Committee.

His municipal career began in 1902, when he was elected to the Newcastle City Council, having been put forward by the Newcastle Labour Party, who re-elected him Chairman year after year. At least twice he lost his seat on the City Council—once when he was Sheriff-elect—but he was soon returned. He was Sheriff in 1922-23 and Lord Mayor of Newcastle in 1930-31, being the first Socialist to hold office. In 1928 he was elected alderman.

At his first attempt to enter Parliament in December, 1918, when he stood for Newcastle West, he was defeated by the late Mr. Edward Shortt. In 1922

he was successful in a triangular contest, but was defeated in the following election in 1923 and contested York City in 1924 and Barrow in 1931 both unsuccessfully. In 1935 he was elected M.P. for the Consett Division of County Durham.

Members who attended the conference at Newcastle in 1932 will remember how successful and enjoyable this was, and how Mr. Adams so largely contributed to this by his personal efforts.

SIR FRANCIS FREMANTLE

WE regret also the death of another good friend from the House of Commons, Sir Francis Fremantle, M.D., M.P. Sir Francis was a member of the Council of the Society and found frequent opportunity to put forward the smoke prevention viewpoint in discussions on the housing and health questions with which he was closely associated

West Riding Regional Committee

Address by the Leeds Housing Director

AT a meeting of the West Riding of Yorkshire Regional Smoke Abatement Committee on October 22nd, Mr. R. A. H. Livett, Housing Director for Leeds, spoke on "Post-War Housing." Discussing the open coal fire he said he would support its abolition, even if only to relieve the architects of the worries of draught. As an idealist in planning, and to be such he would have to be a dictator, he would forbid the open fire and introduce into all houses central heating and hot water, either communal or otherwise, gas and electric cookers, and, where necessary, air conditioning. Such measures would solve the problem of those who support the development of smokeless towns, but Mr. Livett did not think the tenants would be satisfied because of the craving, for another generation or two, for an open fire, and the additional

charges on the housekeeping purse.

In Mr. Livett's opinion the solution for the time being, particularly with respect to low-cost housing, was :

(1) The provision of an open fire in the living room scientifically designed for the burning of smokeless fuel and the introduction of statutory powers forbidding the use of raw coal for domestic use. But we must first be satisfied that there will be a sufficient supply of smokeless fuel always available and at a reasonable price.

(2) The grate should be of the back-to-back type providing a fire in the living-room, baking facilities in the scullery, and a domestic hot water system fed from a back boiler.

Auxiliary cooking facilities could be provided by means of gas or electric cookers and auxiliary hot water for the summer months by the introduction of an immersion heater into the cylinder. For the rest of the house the provision of plug points for gas and electricity would meet all requirements.

Mr. Livett spoke also of the need for byelaws controlling the sweeping of flues—he hoped the time was not

(Concluded on page 34)

The Corrosion of Metals in Air

The Influence of Sulphur Dioxide and of Solid Pollution

A PAPER read by Dr. W. H. J. Vernon, Principal Scientific Officer of the Chemical Research Laboratory (D.S.I.R.) to the Society of Chemical Industry (*Chemistry and Industry*, August 21st, 1943) surveys some interesting results of research on the atmospheric corrosion of metals, as determined mainly by experimental work in the laboratory. Of particular interest is Dr. Vernon's account of the rusting of iron, which is of course the metal most extensively (and expensively) affected by atmospheric pollution.

"The rusting of iron," said Dr. Vernon, "belongs to the category not of film formation, but of film breakdown. Contrary to the popular impression that 'iron does not rust above the dew point,' a clean iron surface will rust freely in an ordinary room atmosphere of low relative humidity (temperature well above the dew point). Interest attaches, therefore, to the 'promoting factor' that is concerned in the process. Rusting proceeds characteristically from sporadically distributed centres having no relation to any factor connected with the metal itself; examination of these centres under a lens suggests the precipitation of nuclei from outside. The number of centres increases with time; but even at an advanced stage of rusting, bright interstices can be seen by the aid of a lens. These observations suggested the experiment of exposing specimens inside a muslin 'cage' with control specimens immediately outside. The result was spectacular because the specimens inside the cage remained entirely free from rust whilst those outside rusted freely. This served to confirm the view that nuclei for the rust centres were provided by disperse solid particles in the atmosphere. After prolonged exposure (during which the control specimens had rusted heavily) the air-formed oxide film on the screened specimens had thickened sufficiently to give a striking degree of protection

(as compared with freshly-cleaned specimens) on subsequent exposure outside the cage. A number of very practical consequences, of importance to the engineer, follow immediately from the results of this simple experiment. Incidentally, the experiment has some bearing on the 'stainlessness' of stainless steel (which may contain some 86 per cent. of iron) as showing that iron itself, with suitable 'assistance,' has an intrinsic tendency to film-formation.

"We turn now to the influence of humidity on the rusting of iron and ordinary mild steel. The rate of attack due to disperse particles at low relative humidities falls off as the available unattacked areas become reduced. At increased humidities a point is reached, in the neighbourhood of 70 per cent. relative humidity, at which an enormous increase in the rate of rusting occurs. This provides a further example of the 'principle of critical humidity,' the importance of which can hardly be over-rated. The mechanism involved has been discussed elsewhere and time forbids more than a passing reference here. One point, however, should be emphasised, namely, that the profound stimulation of rusting that takes place at the critical humidity is not an intrinsic effect on the metal, *per se*, but an indirect effect due to a property of the previously formed rust. An initially clean surface may remain apparently unaffected under conditions such that a heavy accretion of rust takes place on an already 'inoculated' surface.

Influence of "Solid" and "Gaseous" Pollution

"More recently we have re-examined the matter from an entirely different angle. Instead of taking ordinary air and removing material from it (the analytic method) we have started with purified air, and have brought to the metal-air interface controlled amounts of specific nuclei (the synthetic method).

Briefly, the method followed was to 'inoculate' iron specimens with particles of the given substance; the specimens were then exposed either to purified air or to air containing a small concentration of sulphur dioxide. The atmosphere being initially dry, the relative humidity was 'stepped up' at intervals up to a maximum of 99 per cent. at 32 days, the temperature being maintained constant throughout. Thus, although the system was below saturation for the whole period (100 days) the critical humidity was approached and exceeded over a mean period of about 20 days. The results show that the critical humidity is actually duplex in character. There is a 'primary' value of 50 per cent. to 65 per cent. relative humidity at which breakdown of the air-formed film occurs and attack on the metal begins. The surface becomes covered with a very fine 'rust,' starting at isolated centres—but even prolonged exposure at these humidities (in supplementary experiments) fails to produce serious corrosion. Then, at the secondary critical humidity, approximately 80 per cent., a relatively enormous increase in corrosion occurs with the production of ordinary red rust. Confirming that this phenomenon is due entirely to properties of the primary rust, the increase is just as marked if sulphur dioxide (when this is the promoting factor) is completely removed from the system just before the critical humidity is reached. A practical consequence, which must occur not infrequently in service within this 'dangerous' range of humidity, is the loosening of a protective coating that is not entirely impervious to water vapour, particularly if for any reason traces of the appropriate particles are entrapped beneath the coating. Particles such as ammonium sulphate are intrinsically effective in promoting attack; so are traces of sulphur dioxide in the atmosphere in the absence of particles on the specimen; when present conjointly, both factors are additive. On the other hand, charcoal, which has no intrinsic effect, becomes enormously active in the presence of traces of sulphur dioxide, a result that is probably reproduced under service conditions by carbonaceous particles normally present in the atmosphere . . .

"Probably sufficient has been in-

cluded to show how inextricably the atmospheric corrosion problem is bound up with the problem of atmospheric pollution. If we exclude essentially marine atmospheres, then we can say that serious corrosion is rarely due to any 'natural' constituent of the air, but rather to extraneous impurities contributed by products of combustion—and of these, sulphur dioxide is by far the worst offender. Before the present war, much progress had been made in the removal of sulphurous impurities from flue gases. If, after the war, we can succeed completely in this object, then atmospheric corrosion will very largely cease to be a problem."

It may be added that Dr. Vernon's reference to the acceleration of corrosion by carbonaceous particles and (in a graph not reproduced here) silica particles, with sulphur dioxide present, completes the indictment of smoke in its full sense—soot, grit and sulphur acids—as the most serious agent causing the corrosion of metals. Every step taken to reduce any of the main constituents of smoke will lessen the incidence of corrosion, even though only the complete removal of the promoting agent, sulphur dioxide, will secure the maximum improvement possible.

West Riding Regional Committee

—continued.

far distant when all flues would be cleaned by suction plant. Flues should be formed with standardised linings in order that there could be no doubt as to their correct construction.

In recent years we had been paying a good deal of attention to the sound-proofing of our buildings, but it was also important that our buildings should be draught-proof and that we should use lining materials that would ensure the maximum retention of heat and avoid condensation.

Mr. Livett concluded by expressing the hope that builders and manufacturers of household equipment would be compelled to work to a minimum standard specification and that inferior building and third rate equipment would not be permitted to find its way on to the market as it did during the pre-war period.

The Development of Fuel Supply

By E. V. Evans

O.B.E., F.I.C., M.Inst.Gas E. *

IT is instructive, and not without interest, to compute for our own guidance, as well as for that of others, the advantages that we could bring to a town in which our services were utilised more fully than is customary to-day. If I were to take an actual town and describe the possible line of development there, I should be presuming to know more about the affairs of that town than those who are already controlling its destinies. To avoid such presumption it is better to consider the case of an entirely imaginary community whose requirements of fuel are typical of the average throughout the country. This township may be regarded as moderate in size with a population of, say, 200,000 people forming 50,000 families. It would have a normal proportion of industrial premises, commercial buildings and residential quarters. It is not a city of the future, the plans of which we have not yet seen, but a fair sample of things as they are with a Gas Undertaking and an Electrical Undertaking already in existence, but with coal being burnt in the raw state for the greater part of its fuel requirements. It must be assumed that the public utility undertakings are efficient according to modern standards, but that the desire for improvement has been recognised and the various interests are prepared to work together.

Development of fuel supply in our town is considered in four stages. At the first stage the position is broadly typical of pre-war conditions throughout the country. The consumption of gas per domestic consumer is 100 therms per annum. The use of electricity is on a more generous scale than the actual pre-war position, an allowance of 680 units for each domestic consumer being assumed. The balance of the



Photo by courtesy of the British Council

domestic fuel is mainly coal, though a little coke is used. The Gas Undertaking experiences a seasonal load factor of 60 per cent., while the electricity load factor is 33 per cent.

In tracing development from this point most attention has been given to the domestic consumer and full value has not been given to possibilities of expansion in the industrial and commercial premises. This is intentional, because we want to see the effect of developing primarily on these lines.

At the second stage of development considerable progress has been made in the use of gas for water heating in the summer months, and for such other loads (e.g., space heating in spring and autumn and refrigeration) as would tend to improve the seasonal load factor of the Gas Undertaking. The use of coke has been developed to some extent to replace coal as a solid fuel. At this stage no assumption has been made as to the results of co-operation between the gas and electrical undertakings to improve the electrical load factor, and annual consumption of electricity is not taken as being any higher than in the first stage (where it represents about double the actual use throughout the country in 1938).

*A section of the Presidential Address to the Institution of Gas Engineers, 9th June, 1943. Reference should be made to the complete paper for further details and another table dealing with financial aspects.

The consumption of gas per domestic consumer has increased to 210 therms per annum. Now, this could not have happened without modification of the method of charging for gas. At stage 1 the charge for gas was a flat rate of 10.4d. a therm, but to reach stage II a type of tariff has been envisaged incorporating a fixed charge which for the ordinary dwelling would

be 40s. per annum, and would entitle the user to a supply of gas at 6d. a therm for the first 300 therms and 4d. a therm thereafter. This is a type of tariff intended to represent the value to the consumer of a continuously extending service, while remaining—on a pre-war basis of computation—economic to the Gas Undertaking at all stages of development.

Table 1.—Development of Fuel Supply, Stages I-IV: Use of Fuel and Measurable Advantages Obtained

	Stage I	Stage II	Stage III	Stage IV
Allocation of 300 useful therms per domestic consumer :				
Gas	50	105	150	212
Electricity	17	17	26	26
Coke	8	28	124	62
Coal	225	150	—	—
Load factor on utility undertakings, per cent :				
Seasonal load factor for gas	60	70	60	54
Hourly load factor for electricity	33	33	50	50
Total fuel used per annum :				
Domestic—Coal, tons	225,000	150,000	Nil	Nil
Coke, tons	5,500	20,000	90,000	45,000
Gas, therms	5×10^6	10.5×10^6	15×10^6	21.2×10^6
Electricity, kWh	34×10^6	34×10^6	52×10^6	52×10^6
Industrial—Coal, tons	224,000	201,900	228,600	138,600
Coke, tons	30,800	53,300	20,000	108,000
Gas, therms	0.5×10^6	0.5×10^6	1.5×10^6	1.8×10^6
Electricity, kWh	68×10^6	68×10^6	68×10^6	68×10^6
Total coal required :				
For use as such, tons	449,400	351,900	228,600	138,600
For gas and coke production, tons	73,700	146,700	220,000	306,000
For electricity production, tons	62,100	62,100	73,100	73,100
Total, tons	585,200	560,700	521,700	517,700
Products recoverable :				
Tar, gal.	737,000	1,467,000	2,200,000	3,060,000
Benzole, gal.	221,000	440,000	660,000	918,000
Sulphur, tons	330	660	880	1,360
Ammonia, tons	230	460	690	960
Local amenities :				
Smoke pollution of atmosphere (domestic), tons	6,100	4,050	Nil	Nil
Smoke pollution of atmosphere (industrial), tons	2,240	2,020	2,286	1,386
SO ₂ pollution of atmosphere (domestic), tons	9,170	6,300	2,700	1,350
SO ₂ pollution of atmosphere (industrial), tons	12,820	13,030	13,984	10,294
Total Annual Pollution, tons	30,330	25,400	18,970	13,030
Solid fuel transported through streets for retail delivery, tons	230,500	170,000	90,000	45,000
Ash removal from domestic premises, tons	23,000	17,000	9,000	4,500
Probable distribution of consumption per consumer, therms per annum :				
Consumers taking below 100	30,000	10,000	5,500	3,500
100 to 200	17,750	20,000	7,500	5,000
200 „ 300	2,000	14,000	12,000	7,500
300 „ 400	200	4,000	15,500	8,000
400 „ 500	50	1,850	5,500	12,000
above 500	—	150	4,000	14,000

Stage III represents the state of affairs when the use of gas has been extended to cover most of the water-heating and occasional space-heating loads. The seasonal incidence of this latter has caused the Gas Undertaking load factor to fall from the 70 per cent. that was reached in stage II to 60 per cent., but, of course, with an increased output. Coke is assumed to have replaced coal entirely for space heating and for some water heating. At this stage of partial development in the use of gas for domestic heating, it is better that the available coke should be used for the balance of domestic fuel requirements, as its effect in reducing smoke emission is greater when used in this manner than when used industrially. Co-operation between the fuel utility undertakings has led to better balancing of the electrical load factor by using off-peak current for water heating. The annual consumption of electricity has increased to 1,040 units per domestic consumer without any increase in generation or distribution plant. This represents an electrical load factor of 50 per cent. and permits a fall in the average price of electricity from 0.982d. per unit to 0.706d. per unit, a measure of improvement which probably represents the practical limit

of load balancing.

At stage IV the gas supply has developed to the point at which 50 per cent. of all domestic consumers have dispensed entirely with solid fuel and use gas exclusively for heating, while the other half continue to use gas and coke as they did in stage III. This development has resulted in an increase in gas consumption to 424 therms per consumer per annum but the load is obviously more seasonal and the Gas Undertaking load factor has consequently fallen to 54 per cent.

Detailed figures of the use of fuel, the measurable advantages obtained, and the financial aspect of the changes made at each stage are given in Tables 1 and 2. It is impossible to express either numerically or graphically the greater convenience in running the homes of this town, or to evaluate the improvement in the conditions of living, the greater cleanliness and the effects of a purer atmosphere. Those items that can be measured show what immense progress is possible. Although the town as a whole consumes in stage IV nearly 70,000 tons of coal less per annum than in stage I, the amount of secondary products available for use in the town, or for sale outside, has increased four-fold. Atmospheric pol-

Table 2.—Development of Fuel Supply, Stages I-IV : Financial Aspect

	Stage I		Stage II		Stage III		Stage IV	
	£		£		£		£	
Capital required for fuel utility services :								
Gas manufacture	314,000		540,000		941,000		1,460,000	
Gas distribution	667,850		752,350		902,350		1,095,350	
Total for gas	981,850		1,292,350		1,843,350		2,555,350	
Electricity generation	620,000		620,000		620,000		620,000	
Electricity distribution	1,560,000		1,560,000		1,560,000		1,560,000	
Total for electricity	2,180,000		2,180,000		2,180,000		2,180,000	
Total for fuel services	3,161,850		3,472,350		4,023,350		4,735,350	
Investment <i>per capita</i>	15.81		17.36		20.16		23.68	
		Cost		Cost		Cost		Cost
Fuel bill of average domestic consumer :		£ s. d.		£ s. d.		£ s. d.		£ s. d.
Coal, tons	4.5	10 2 6	3.0	6 15 0	—	—	—	—
Coke, tons	0.11	0 4 10	0.4	0 17 7	1.8	3 19 2	0.9	1 19 7
Gas, therms	100	4 6 8	210	6 18 3	300	8 14 10	424	10 19 4
Electricity, kWh	680	2 15 7	680	2 15 7	1,040	3 1 3	1,040	3 1 3
Total cost		17 9 7		17 6 5		15 15 3		16 0 2
Average selling price of gas and electricity :								
Gas, pence per therm	10.4		7.90		7.00		6.22	
Electricity, pence per kWh	0.982		0.982		0.706		0.706	

lution by smoke has been reduced to a point at which it is no longer a serious nuisance. Sulphur-dioxide emission is confined mainly to industrial premises where the problem can be tackled by treatment of waste gases. Transport problems of solid fuel and the costs of ash removal are both eased to the point at which they no longer hamper the life of the town. The capital investment in fuel utility services has increased by nearly £8 per head of population, but the fuel bill of the average domestic consumer shows a substantial reduction. Both gas and electricity show an increase in use to three or four times the normal pre-war figure and the price of each has been reduced 30 to 40 per cent. It is clear that within such a general scheme of development a great deal of liberty is allowed to the individual consumer in selecting methods of fuel usage which accord with his particular taste. At each stage in the development the scheme is economic and there is no necessity either to hesitate over commencing the expansion because the ultimate result is doubtful, or to insist upon progress being speeded-up artificially in order to reach an economic position within a limited term of years. Surely, such a scheme is likely to appeal far more to those who wish to see the practice of fuel utilisation improved by public enlightenment than the much-discussed schemes of district heating which require a high degree of standardisation in the equipment of homes and the habits of the people.

In this attempt to depict numerically the progress of coal-processing along lines already known to us, no radical changes in technique have been presumed. Little attention has been given to the full development of the use of gas in commercial and industrial buildings, though the scope for bringing the advantages of gaseous fuel to the workplace as well as to the home is great and still much under-developed. The reasons for giving so much attention to the domestic consumer are that this class of consumer already provides the greater part of the demand for gas, that the need for improvement is greatest in the homes, and that progress is likely to be slowest in that field which directly affects the lives and customs of millions of people.

THE SMALL HOUSE

A NEW volume of the excellent "Design for Britain" series (Dent, 6d. each) is "The Small House" by Marion Fitzgerald. In this small volume you will find no well-meaning but impracticable notions of what small houses might be if the world was not what it is, and if people were not what they are, but a thoroughly practical discussion of what can be done and what should be done to make the smaller type of house a thoroughly comfortable and efficient place in which to live. The author's first words, in fact, are to say that the object of the book is "to outline the essentials of a warm, pleasant, comfortable, labour-saving and economical house." Miss Fitzgerald knows, from actual experience and careful observation, what she is writing about, and what the average housewife is likely to think about it.

We are glad that she devotes so much attention to the warming of the house, and that she stresses so well the case for smoke prevention. The Society's memoranda on post-war housing are quoted, and one point made we should like to see drilled vigorously into every women's organisation in the land: "The greatest labour-saving device—far better than a dozen gadgets—is a smokeless house. No other single improvement would do so much to set the woman in the house free from drudgery."

Details That Matter

Miss Fitzgerald has an eye for points that nine authors out of ten—and the same proportion of builders and architects—would never think about until, too late, they themselves came to live in a small house, and in a community of small houses. One such point, for instance, is that intersecting footpaths, running between gardens, should link up different parts and roads of a housing estate. A minor detail, so easily never thought of, and yet how great a boon for all time to people who may, day after day, have to take circuitous journeys along and around barriers of unbroken rows of houses.

Conference in Pittsburgh

AMONG the principle topics discussed during the three-day Annual Convention of the Smoke Prevention Association of America in Pittsburgh, on June 8th to 11th, were the collection and analysis of fly ash, the smoking tendencies of various coals, overfire air, control of railroad smoke and problems incidental to the many conversions from oil to coal.

Dr. Rose reviewed the classification of coal. As to smoking tendencies, anthracite with 2 to 8 per cent. volatile, which contains no tar and the volatile of which is mostly hydrogen, is inherently smokeless. Semi-anthracite, with more than 8 per cent. volatile, is substantially smokeless, although its small tar content under certain conditions may give a slight trace of smoke and its burning is usually accompanied by a detectable odour. From 5 to 12 per cent. of the heat given up by anthracite may be credited to the volatile.

Coming to the bituminous coals, the speaker showed that the tar content increases almost directly with the volatile. The tar in low-volatile coals will range from 30 to 120 lb. per ton; that in medium volatile coals up to 200 lb. per ton; and for high-volatile coals as much as 300 to 350 lb. per ton which is equivalent to a barrel of tar per ton of coal. Nearly half the heat in such coals is contained in the volatile matter.

Fly Ash

"The Collection and Disposal of Fly Ash from Spreader Stokers" was the subject of a paper at the second session by K. H. Bowman of the Dravo Corporation. Inasmuch as the fly ash in such cases may consist of as much as 40 to 60 per cent. combustible, the speaker stressed the necessity of ample furnace volume to permit time for burning, the importance of over-fire air to increase turbulence, and automatic control. He described a type of mechanical arrestor which his organisation had found effective. This consists of a helicoid inserted in a cylinder having slots which is placed in the stack. The helicoid produces a whirling

motion to the stack gases and the fly ash is thrown out through the vertical slots in the cylinder and drops down into a hopper. All the coarse and some of the fine particles are thus removed. Because the velocity is low, the draught loss, through the spiral, is low, not over 1/10 inch, and an induced-draught fan is necessary only if the stack is short.

Smoke Surveys

Reporting on the results of "Surveys of Heating and Power Plants in Various Cities with Recommendations for Smoke Elimination," C. F. Hardy, of the Coal Producers' Committee for Smoke Abatement, told of some 600 plants visited, only 2 per cent. of which were in first-class condition and well operated. They were, for the greater part, small installations, many hand-fired and supplying steam for heating or power for relatively small industrials. The biggest smoke offenders were the hand-fired plants whose firemen had various other duties besides attending to the boilers. Poor draught conditions were common; nearly 60 per cent. of the plants visited had leaks in the breeching or settings; in many of the stoker-fired plants there was a lack of turbulence in the gases; and a practice all too prevalent was that of shovelling coal on top of the stoker fuel bed and barring, in order to meet increased load. This was productive of smoke.

Railway Smoke

One session was devoted to two papers on railway smoke. In the first of these, W. H. Kimberly, Smoke Inspector of Pittsburgh, told of the close co-operation on the part of the railways entering that city, of their system of having company smoke inspectors and the close check that the latter maintain against not only violations but any smoke not serious enough to constitute a violation.

In another paper the speaker showed that the avoidance of smoke is a matter that concerns the locomotive engineer in his handling of the throttle and cut-off even more than the fireman.

MORE SUPPORT FOR SMOKELESS HOUSING

THE first session of the Conference held in London on November 23rd to 24th by the Sanitary Inspectors' Association was devoted to Housing, and several speakers in the discussion referred to the need for measures to ensure it being smokeless. Mr. J. W. Beaumont, of Halifax, spoke on the action taken in Manchester in forming a special committee to deal with the problem in relation to reconstruction and ably urged sanitary inspectors to support the formation of such committees in their own districts. Mr. Wade of Nottingham also referred to the subject, and said that they were alive to the problem in his city. Mr. Marsh, the Society's secretary, asked for the question not to be treated as an isolated factor but to be integrated as a cardinal point in the general problems of the use of fuel and the utilisation of heat in the home.

A memorandum submitted by the Sanitary Inspectors' Association to the Central Housing Advisory Committee contains a paragraph on "Heating Arrangements," which is almost completely a statement, and an excellent one, of the need for smoke prevention. It will be useful to record it in full:

"The Association feels that proper attention has not been paid to the provision of heating and warming arrangements which, whilst efficient for the purpose for which they are intended, nevertheless are smokeless in action. One of the major problems for the post-war period is the abolition of atmospheric pollution and drastic steps will be necessary if success is to be achieved. It is true that the traditional method of heating the English home is by means of the open coal fire, and although great strides have been made in the use of gas, electricity and smokeless fuels, the vast majority of dwelling houses still burn raw coal to a considerable extent, with consequent production of smoke. Moreover, many grates are inefficient and wasteful, the combustion efficiency is low, smoke is emitted, and the greater part of the heat produced is lost up the chimney. Not only does the open fire produce smoke which pollutes the external atmosphere, but the burning of raw coal causes much dirt and dust

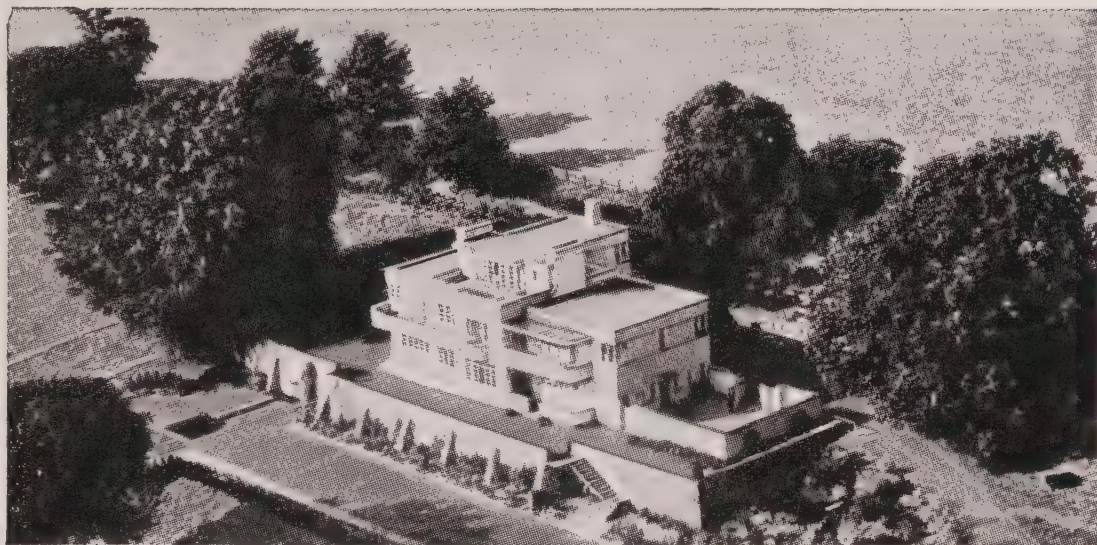
in the house itself, thereby adding to the labour of the housewife.

"The Association is strongly of the opinion that the post-war building programme, including the erection of dwelling houses, offers a unique opportunity for the adoption of smokeless methods of heating and warming, and the possibility of changing the traditional methods at present in force. Where open fires are provided the grates should be designed for the use of smokeless fuel. A carefully planned publicity campaign would do much to secure the support and approval of the public in general and this, coupled with the more efficient distribution of gas, electricity and smokeless fuels, should create the necessary public support and demand for smokeless methods of heating and warming. Where open fires are not fixed extra care should be taken to ensure adequate ventilation of the rooms by natural means. Consideration should be given to the provision of high efficiency cookers combined with arrangements for heating water in ample quantities."

The R.S.I.

At a conference on Housing earlier this year, of the Royal Sanitary Institute, were included brief references to smoke prevention in two of the papers presented. Mr. Percival T. Harrison, Borough Engineer and Surveyor, Finchley, said: "It is to be hoped that in the great building programme to be carried out in the next few years a serious attempt will be made to reduce the smoke nuisance. Improvement can be effected by encouraging the use of smokeless fuel and by installing grates that ensure maximum combustion; but one effect of this war will be no doubt a reduction in the number of devotees of the coal fire."

Mr. George Laws, Chief Sanitary Inspector and Housing Officer, Richmond, said: "Reform must have regard to the prevention of domestic smoke, which is of first-rate importance in the solution of the smoke problem . . . Much saving of labour and a reduction in the emission of black smoke might be effected by the elimination of coal fires and the substitution of gas and electricity."



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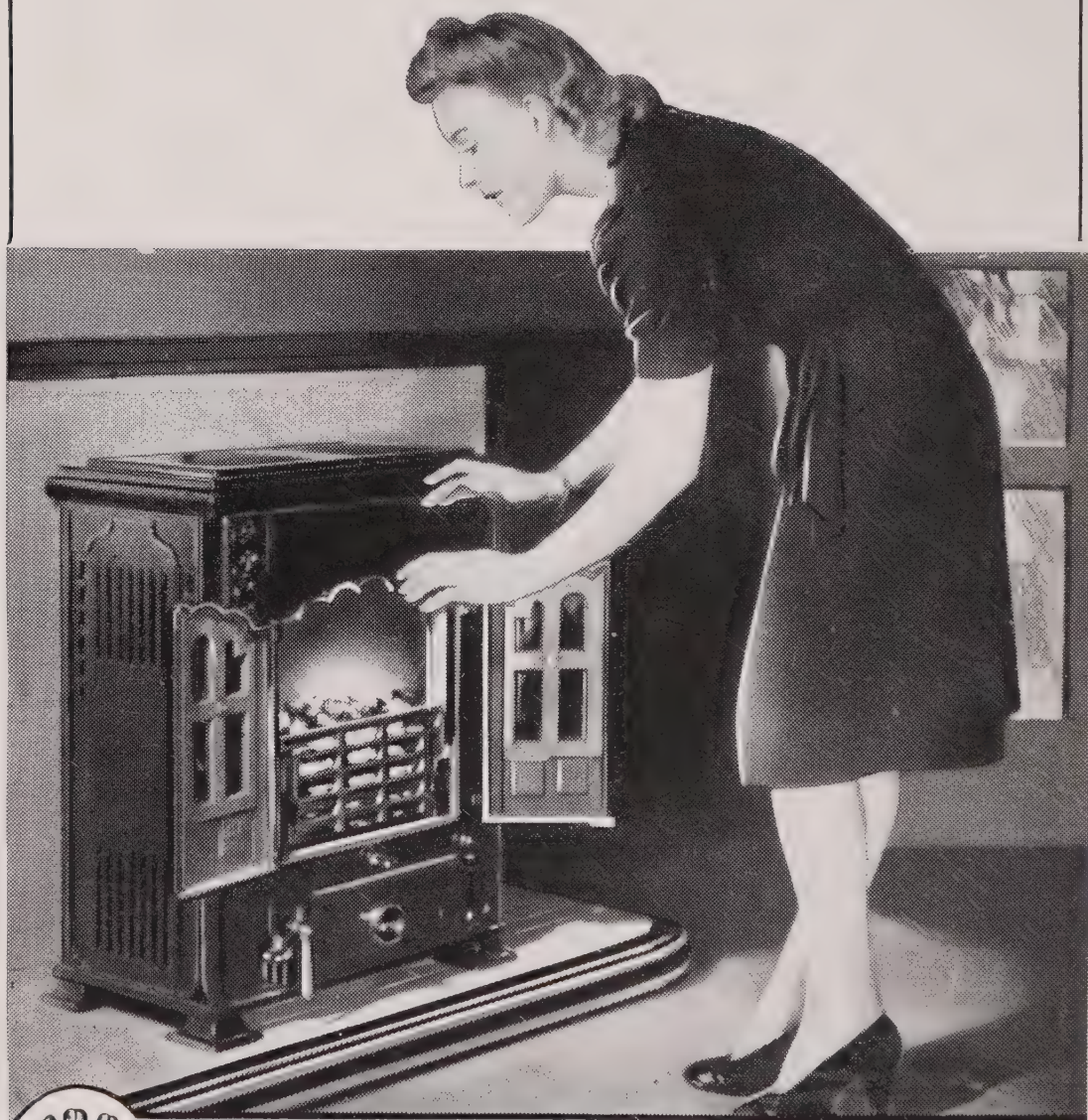
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SMOKELESS AIR

Lord Woolton

"Let us," said Lord Woolton, "encourage those who by their researches are trying to make to-morrow better than yesterday, and let us have the courage to try out new methods and encourage new ideas and new inventions. I am thinking of the very practical world of the home and the kitchen. Let scientific application be used to reduce domestic labour, waste and bad living conditions." The Minister was speaking at the annual luncheon of the Parliamentary and Scientific Committee. We sincerely hope that these brave aspirations may be translated into hard realities, but until the home is freed from its obsolete smoke-producing appliances and until it is situated in an environment of clean air, unnecessary domestic labour, waste, and bad living conditions must continue. We believe that Lord Woolton,

himself a citizen of no clean city, will appreciate the truth of this.

The Barlow Report

So many reports and memoranda are published these days, and so many subjects may touch upon some aspect of our problem of smoke that it needs an eagle eye and an abundance of time to make sure that nothing of importance is missed. Thus we have been very late in noting and recording in these pages the significant evidence of the Registrar-General for England and Wales to the Royal Commission on the Distribution of the Industrial Population. The four main reasons for the higher mortality that still prevails in Great Britain in towns as compared with the country were, he stated, the crowding together of houses, the crowding of people in houses too small for them, the aggravation by

urban conditions of other adverse effects of economic pressure upon the standard of living and environment, *and the production of smoke from factories and homes which reduces the effective sunshine.* Such a statement from this highly authoritative source helps to confirm the opinion held by many that the loss of sunlight (including of course daylight and ultra-violet rays) is the most serious of the effects of smoke upon health, while health in its turn is the most serious of all the manifold consequences of the evil.

Air Pollution

Although the Annual Reports of the Investigation of Atmospheric Pollution are not being published during the war a Summary Report for the year ended March 31st, 1943, has been issued. It shows that during the year the following instruments were being maintained by the Co-operating Bodies: 99 deposit gauges, as against 127 in 1939-40; 8 automatic filters as against 11; 7 volumetric and 40 lead peroxide apparatus for sulphur as against 12 and 60; and 6 daylight apparatus as against 13.

The report confines itself mainly to showing, as far as the observations make possible, the effects of the fuel economy campaign upon the extent of pollution. Compared with the previous year there was a 9 per cent. decrease in tar, a 6 per cent. decrease in soluble matter, and a 6 per cent. decrease in sulphates. With the automatic filter two Glasgow stations showed considerable decreases (24 and 5 per cent.) but others showed no appreciable change.

A significant improvement in the sulphur dioxide concentration by the lead peroxide method has been observed. In Great Britain as a whole, for the months of September, 1942, to March, 1943, there was a decrease of 11 per cent. compared with the corresponding months of the previous year. It is considered that the result is consistent with a decrease in coal consumption during the first seven months of the fuel economy campaign. Although it is not referred to in the report the influence of the smoke production instructions should presumably be taken into account. The report for 1941-42 stated that there was strong evidence that pollution had

increased, in general, since the war; whereas in 1942-43 there was, as shown above, a decrease. It might well be that in the former year efforts were being made to increase smoke emission, but that in the following year this tendency was more than cancelled by the imperative needs for fuel economy.

Ministry of Fuel and Local Authorities

The Ministry of Fuel have recently asked their Regional Fuel Controllers to approach the Local Authorities in their area, requesting that they should be consulted before recourse is had to the smoke abatement provisions of the Public Health Acts, 1936. The reason for this request, we understand, is that within the general and increasingly serious shortage of coal, there are peculiarly acute difficulties in maintaining the supply of certain grades, and therefore many consumers are having to use grades of coal different from those which they normally consume. In certain circumstances this may make it difficult for them to avoid the emission of smoke or grit. Such difficulties can often be overcome with the help and advice of the Regional Engineers.

This move, we feel, is a valuable step towards that prevention of industrial smoke by technical assistance and advice which should always precede, and generally make unnecessary, prosecutions under the Acts. It also supplements the excellent work being done by the Ministry in the education of stokers—a practical means for fuel economy and smoke prevention that the Society has sought to encourage for many years past.

The Price of "Coalite"

A speaker at the Society's conference last November suggested that the price of "Coalite" had risen more than was necessary. Colonel Bristow has sent us some figures which show very clearly how the rise in the price of fuel has been quite unavoidable. To begin with the price of the coal from which it is made has risen by 11s. a ton, and as it takes $1\frac{1}{2}$ tons of coal to make 1 ton of "Coalite" this item alone raises the price by 16s. 6d. a ton. The margin to the retailers has also had to be increased by 1s. a ton and railway rates have increased by 10 per cent. or

more. In some parts of the country "Coalite" has at present to be brought much longer distances by rail than was necessary before the war, and in these areas the extra cost of transport has still further increased the selling price. Thus over £1 a ton has had to be added to the pre-war prices, without taking into account the increased cost of labour at the coke-ovens and all the general increases in costs that the Company, in common with every undertaking, has to bear. We are glad to print this information because "Coalite" means much to the smoke prevention movement.

The Forces and Smoke

The Burnley Rotary Club has been sending a questionnaire to townspeople now serving in the Forces dealing with plans for post-war Burnley. One common factor in the replies is appreciation that people in the town are thinking and planning for the future. Another of the points common to the Forces' letters, says the *Burnley Express* account of a discussion on the replies by the Rotary Club, "was the need to combat Burnley's smoke nuisance." It is encouraging to find that such a desire has grown among those who have for the time being had to live away from their native town, and in all probability it is largely due to the experience of living in cleaner and sunnier districts, both in this country and abroad. After all, there is a noticeable difference between, say, the air of the Mediterranean and that of south-east Lancashire.

Questions in Parliament

On February 23rd, in the House of Commons, Mr. Keeling asked the Parliamentary Secretary to the Ministry of Works whether it is intended that the grates in the experimental houses at Northolt shall be either of the new non-smoke-producing type or suitable for burning smokeless fuel.

Mr. Hicks: As my noble Friend has explained, in another place, the houses referred to are for the specific purpose of demonstrating alternative methods of house construction and ascertaining comparative costs. It is considered, therefore, that all questions of heating and cooking should be studied and dealt with separately, in consultation with my right Hon. Friend, the Minister of Fuel and Power.

Mr. Keeling: Does not the hon. Gentleman think it is a pity that in these demonstration houses there is no sign whatever of any progress in smoke abatement, in spite of all the money which has been spent on research? Will the hon. Gentleman consider representations on this subject?

Mr. Hicks: I cannot agree with the first part of the hon. Gentleman's supplementary question, but in regard to the second part, the answer is, "Yes".

On March 14th, Mr. Keeling asked the Minister of Fuel and Power whether he will circulate in the Official Report the Government's plans for abating the pollution of the atmosphere by industrial and domestic smoke.

The Minister of Fuel and Power (Major Lloyd George): The subject of smoke abatement is a complicated one which is under consideration by a number of Government Departments. I regret that it is not now possible for me to deal with it within the limits suggested by my hon. Friend.

Mr. Keeling: Does my right hon. and gallant Friend appreciate that it is important to have a policy for smoke abatement before the plans for new building are approved?

Major Lloyd George: Yes, Sir.

We regret that space prevents us from giving, in this issue, a report of a speech dealing in part with smoke prevention made by Major Markham (Nottingham South) in the debate on the Air Estimates on February 29th.

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COAL

THE question sometimes arises as to what extent the Society is entitled to promote its objectives of smokeless air by supporting or associating itself with proposals and policies that, although they incidentally help smoke prevention, have primary purposes that are strictly speaking of no concern to the Society. If we lend our support to these other purposes, because of the incidental promotion of smokeless air that will accrue, we are in danger of being accused of what is called special pleading. But if we go to the other extreme and say that we are unconcerned about anything but the prevention of smoke, do not care how it is done so long as it is done, and ignore all other consequences, we shall very quickly become impracticable and be accused of being ineffective and ridiculous.

In practice we find we cannot isolate smoke prevention, but are forced to take an intelligent interest in all the ramifications of the ways and means of accomplishing our ends. Moreover, in questions involving the utilisation of fuel, which interest us primarily because of their bearing upon smoke prevention, the Society cannot altogether avoid acting as an association of citizens whose interests are broad and varied.

This question of the Society concerning itself in subjects that include but extend beyond its declared objective is particularly acute in regard to the important and complex problem of the utilisation of coal, and particularly in

regard to the use of raw bituminous coal. In theory, we should not be interested in whether coal is burned in the raw state or not, whether it is burned efficiently or is grossly wasted, so long as it does not pollute the atmosphere. That is all very well, but how can those who constitute the Society, as a result of their concern about smoke, refrain from becoming convinced that the problem of coal includes and transcends that of smoke, and that the latter can best hope for solution when the nation understands and deals with the major problem? Any study of the fuel question inevitably leads to the conclusion that the present haphazard use of coal, and especially the burning of raw coal, is basically wrong, and that the smoke problem is but one of its subsidiary wrongs.

From many points of view the truth of this statement is made apparent, and it is being emphasised more and more by writers and speakers who, from different starting points, arrive at remarkably similar conclusions. Let us examine some recent contributions to this supremely important debate.

A National Plan

First, a town-planner makes a strong and closely reasoned plea for a national planning policy, which, from his analysis of the needs of the nation, must be largely based on a policy for coal utilisation. Mr. Gilbert McAllister, Chairman of the London Planning

Group, in a recent paper showed how post-war plans are largely isolated from each other, and how the various city plans are unrelated to the problems of the country as a whole, particularly with regard to the development of industry and effective use of our natural resources. The basis of the national plan, he concludes, must be our principal natural asset—coal.

“When we think of South Wales, or Clydeside, or Tyneside,” said Mr. McAllister, “we think of areas which have become the populous regions they now are because of one commodity—coal. On coal they have developed, on coal they have declined. It is, therefore, all the more tragic, but I do not think it an unfair criticism, that the Government has not shown itself a conspicuous success in the handling of the coal industry. We have in peace time recklessly squandered a great national resource and we have allowed the manpower of that industry to deteriorate through unemployment and to be depleted through neglect. Was this not precisely what happened with agriculture before 1914 and again between 1919 and 1939? It has taken two wars to make us realise the importance of agriculture. Is it going to take three to make us realise the importance of coal? Here is an industry which uses as its raw material a mineral which we allow to be expended in our domestic hearths, in our factories and even in our ships, in a way that we know to be hopelessly uneconomic, using it in such a way that many of the valuable by-products are entirely thrown away. It is a big decision, but somebody has got to decide the way we are going to use our coal resources in the future. If we decide that our present use is thoroughly inefficient and that we are recklessly squandering what is in essence a dwindling resource, and that, therefore, all the coal mined in the future will not be transported in raw form in millions of separate hundredweight bags to millions of separate houses, but that coal will be used as a raw material and not as a fuel, we shall not only have eliminated an enormously expensive and wasteful use of transport, *but we shall at last secure the by-products for other industries.*”

Mr. McAllister went on to describe the chemical wealth obtainable from

coal and referred to the tragic waste of coal that gives rise to the smoke nuisance.

“It is even more tragic,” he continued, “that in the face of these facts the Government should still be thinking of substituting for doles to the individual miners, doles to the coalfields in the shape of factories, light industries induced, cajoled, or bribed to go to them, *when there in the coalfields is the basis of our national wealth and the basis of a thousand light industries which ought properly to be established there.* Light industries for South Wales by all means—but do not drag in any irrelevant industry that can be induced to settle there. Let the industries grow from the natural wealth of these areas in such a way one can see great, vital, and indigenous prosperity coming to the special areas. Planning would then be positive rather than merely a process of applying ill-fitting bandages to the running sores of our national life . . .

The Technologist's Policy

Thus the planner, looking forward to a national plan. His conclusions find support in an entirely different technical paper read to the Institute of Fuel on February 1st, 1944, by Mr. Harold Moore, on “Liquid Fuels and Organic Chemicals from Coal and Home Refined Petroleum.”

Mr. Moore reviews the present methods for the pre-treatment of coal, by carbonisation, hydrogenation, and the Fischer-Tropsch process, which give us liquid fuels, lubricants, and the raw materials for the organic chemical industry. The war has brought changes that will make it necessary for this country to limit the value of imports in the post-war era, and has seen the discovery of technical processes which have made petroleum the raw material of a vast new chemical industry. These changes will necessitate the adoption of some State policy to meet altered conditions. The primary objectives of this post-war policy should be, in Mr. Moore's words :

- (a) To provide the liquid fuels and lubricants necessary for road transport, aviation, industry and for the many other essential services at present supplied with petroleum products.
- (b) To provide raw materials in

adequate quantity, suitable quality and low price for the organic chemical industry.

- (c) To provide the maximum possible amount of remunerative internal work in this country, particularly during the immediate post-war years.
- (d) To maintain the best possible trade balance, i.e. to import the minimum value of products whilst giving every assistance to export trades.

The author considers that the most important points in this plan are the extension of the carbonisation industry and the development of the home refining of petroleum. He believes that it can be proved at the present time that a home refining industry will be of great national advantage, and that the development of synthetic processes based on petroleum opens up almost unlimited new fields and, consequently, the adoption of home refining is much more important than is at present apparent.

"If something can be done," the paper continues, "to increase the quantity of carbonisation carried out in this country, it will augment the liquid fuel supplies and increase the total quantity of phenols, creosols and other organic bases for the chemical industry.

"If more coal is to be carbonised it is necessary to inaugurate a campaign in order to increase the use of gas, which should reduce the consumption of raw coal in both domestic and industrial plants, also to encourage the use of gasworks coke for domestic heaters in central heating installations, and legislate with a view to making the use of smokeless fuels (*i.e.*, low temperature cokes) in domestic fires more prevalent. The manufacture of coke oven coke is dependent upon the demands of the metallurgical industry and cannot so readily be expanded by propaganda or legislation.

Possible Legislation

"How to attain these ends is a difficult problem, but the advantages of the change are so far-reaching that the use of the power of the State is fully justified. Propaganda alone would be insufficient, but combined with legislation the desired result should be attained. Such legislation might take the following form.

"The qualities for coal used for burning in the raw state would be made subject to control by the Minister of Fuel, and coals would be classified according to their volatile content or suitability for burning in the raw state. The sale of highly volatile coal suitable for carbonisation for domestic use would then be prohibited, whilst a limitation would be placed on the burning of similar coal for industrial purposes. In the first place, very little pressure would have to be exerted, as practically all types of coal would be licensed for external combustion; but as the necessary extra carbonising equipment was installed and the technique of smokeless fuel production improved (which would be inevitable with increased demand), the restrictions could be tightened by using a stricter specification for controlling maximum volatile contents permissible in coal to be burnt in the raw state. Should some such scheme take effect, we could expect the following results:—

- (1) An improvement in the overall efficiency of fuel utilisation resulting in some reduction in the quantity of coal mined and thereby a less rapid exhaustion of our greatest natural resource.
- (2) Less employment underground but very considerable increase in employment in the carbonising and subsidiary industries.
- (3) A great reduction in atmospheric pollution with its resulting injury to agriculture, buildings and general amenities.
- (4) A considerable increase in the yield of liquid products, particularly liquid fuels for internal combustion engines and materials for organic synthesis.

"It might be feared that the increase in the carbonisation industry resulting from such a move would result in too great a production of coal tar and thereby depress the markets for the tar products. The likelihood of this occurring is not really serious and can be entirely prevented by the restriction of taxing of certain imported liquid fuels."

Still another paper, on "Post-War Coal Processing" by Messrs. G. M. Gill and John Roberts (read to all the Chemical Societies and the Institute of Fuel at Bristol, January 13th, 1944) expressed fundamentally similar views,

although approaching the problem from a rather different angle. Here the authors showed how employment can be promoted by the processing of coal: "The extra employment is created by extracting the noxious smoke-yielding constituents from coal. The smoke is waste and a nuisance, hence we recover health from waste, and at the same time help to create a clean atmosphere The task of replacing the whole of our domestic coal with smokeless gaseous and solid fuel is a formidable one, but technically there is no difficulty and therefore there should be no commercial difficulty."

The Conservation of Coal

The first and second points enumerated by Mr. Moore above are worthy of detailed consideration. The first raises the fundamental question of coal conservation, which must mean, if it means anything at all, a progressive decrease to a certain minimum of the coal mined; while the second briefly indicates how the change of employment that will be involved should be dealt with. This development is of course closely related to Mr. McAllister's views from the national planning point of view.

The importance of coal conservation as a definite objective in a national fuel policy is becoming more widely recognised and here we may quote an important article that appeared in *The Times* of February 7th, 1944:—

"British coalmining is now approaching the stage when the seams from which coal is most easily and cheaply won will become exhausted. Within a generation or two Britain will be left with possibly inferior, and certainly more expensive, coal than other industrial nations such as Germany and the United States, which will not reach this stage for another 200 years. Industry depends on cheap coal for many processes—'cheap' in the sense of sufficiently low in price to allow competition with other nations, having regard to the cost of fuel in those countries. In the future it will be vitally important to use coal as sparingly as possible, so that supplies may be conserved, and to use for any given purpose the most suitable type of fuel, having regard to coal conservation and fuel costs per unit of output."

The author urges the formation of a Fuel Advisory Council to promote this

aim, to establish upon a permanent basis the co-ordination of all the fuel interests, and to secure the best use of each form of fuel and power in the national advantage. One portion of the article emphasises the smoke nuisance as one of the most difficult problems with which Britain has wrestled unsuccessfully for some 400 years. "The destruction of social amenities and the unnecessary labour occasioned by smoke are problems calling for the immediate attention of the Government; it is still left to a voluntary body, the National Smoke Abatement Society, to urge a reform that is long overdue. The solution of the problem calls for the use of smokeless fuels and the careful control of plant, both as to existing and future heating installations."

The House of Lords Debate

In July last a most interesting debate took place in the House of Lords on Scientific Research, with particular reference to coal utilisation. The debate was opened by Viscount Samuel, who touched upon the basic scientific attitude towards coal: "For thousands of years man has been digging in the ground and getting out coal and burning it raw in furnaces or fireplaces. It is only in recent times that it has been realised that that is an exceedingly crude way of dealing with it." The Earl of Listowel referred directly to the smoke nuisance as one of the consequences of the wastage of an immense quantity of coal. "It is no less true," he said, "that coal should be regarded as a raw material as well as a source of energy and that we have scarcely begun to explore its possibilities as a purveyor of chemicals and liquid fuels . . . what counts more in the minds of the general public is the chance science gives us of dispelling the grey pall of smoke that has enveloped our large industrial towns for the last hundred years."

The most penetrating expression of the scientific approach to coal was made by Lord Cherwell, replying to the debate on behalf of the Government. One sentence sums up in nine words the essence of our problem: "To live upon coal is to live upon capital." A later section of his speech must be quoted at length:

"As I have said, coal is valuable not only as a fuel to give us heat and

power; it is also far and away our most important chemical reducing agent: without it, it is difficult to see how iron and steel could be got in industrial quantities. Further, it is one of our most important sources of organic compounds. As one noble Lord mentioned, living organisms have the faculty of building up atoms and molecules into elaborate structures, many of which we have not yet been able to imitate in the laboratory. The more complicated of these, of course, have been destroyed in the millions of centuries since the decaying vegetable matter was laid down which now forms our coal seams. But many of the hydrogen compounds and some of the nitrogen compounds remain, and a large proportion of the many-hued products produced by the dyestuffs industry have as their starting points chemicals found in coal tar. Many plastics and innumerable other valuable chemical substances have a similar source. We must beware of wasting the heat stored in our coal; but it is far worse to destroy these valuable molecules which have been built up in the course of scores of millions of years."

A Five Point Case

From these papers and statements a clear picture emerges of how we must consider coal and its utilisation. To attempt a summary of the conclusions that we have drawn we can say:

(1) *From the scientific viewpoint*: It is necessary to prevent the wasteful destruction of the valuable organic chemical wealth that is in coal.

(2) *From the long-term economic viewpoint*: It is necessary to conserve our dwindling coal reserves as carefully as we can—on account of the increasing cost of mining, the decreasing quality of coal, and the ultimate exhaustion of the coal seams.

(3) *From the short-term economic viewpoint*: It is necessary to plan to secure the raw materials of industry and the liquid fuels that will be factors of first-rate importance in Britain's post-war industrial prosperity and development.

(4) *From the national planning viewpoint*: It is necessary to create a comprehensive and integrated national plan, in which one of the bases must be a wise development and utilisation of

our principal asset, coal; and to create prosperity in the coalfields by industries using coal as a raw material.

(5) *From the social, health and amenities viewpoint*: It is necessary to end the smoke nuisance by substantially raising the standards of fuel utilisation in harmony with the first four points.

Now even if each one of these points has been over-stated or over-simplified, or even if there are real objections and technical difficulties, it must remain abundantly clear that taken altogether the five points make an unanswerable case for a bold fuel policy that includes a progressive and planned reduction in the amount of coal used in the raw state as a fuel. Sooner or later this policy will have to be adopted, and from every point of view the sooner the better.

We believe that this analysis of the position and the needs of the future will be broadly accepted by all who have closely studied the problem, and we believe, too, that they will agree that the time is ripe for a campaign to educate the nation on the facts of the case. It must be made clear to all that coal must be regarded in a new light, and that we can no longer afford to burn it in the old wasteful ways.

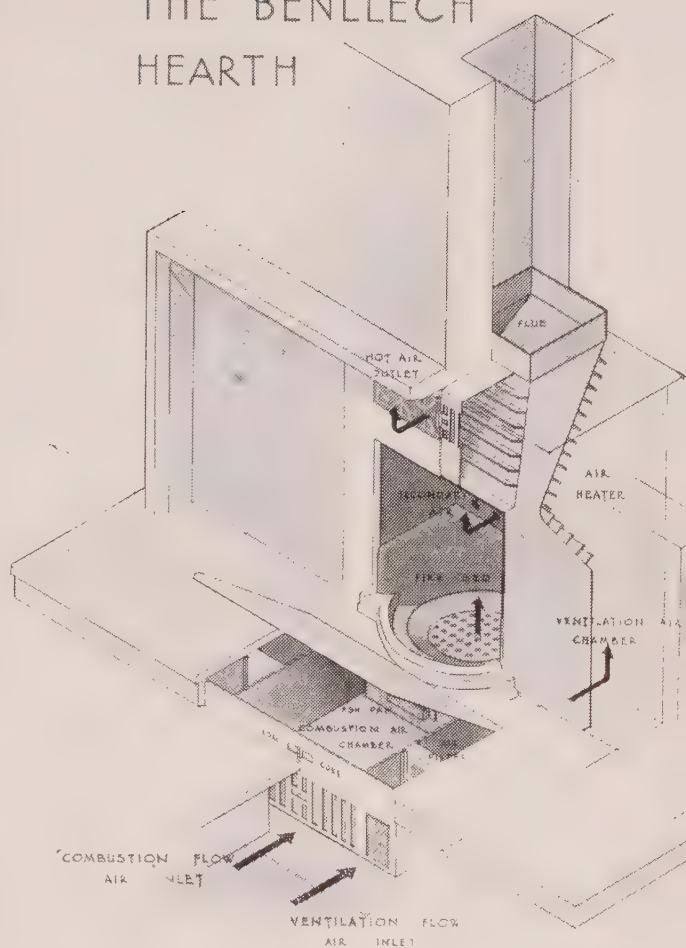
But there is another side to the picture. Among the excellent and valuable researches being conducted by the British Coal Utilisation Research Association, a body largely supported by the coal trade, there is actually work in progress—and which has received plenty of publicity—on a new type of open fire *that is primarily intended to perpetuate the use of raw coal for domestic purposes*. It is true that it is a greatly improved type of open fire, that it will reduce labour and will burn smokeless fuels, and also that it will reduce smoke emission when bituminous coal is used. We hope to review it in these pages when full information is released, but even now we can say that it is an excellent piece of work and creditable to those who have expended their skill and labour upon it. We should have no criticism to make if B.C.U.R.A. were to say, in effect: "This is a fire in which for the time being coal may be used, but it is primarily intended for fuels derived from coal. As soon as possible coal must cease to be used as a

fuel, especially for domestic purposes.”

But the fire is, of course, intended for coal, and is the response of the coal trade to the evolutionary changes in domestic heating that are now in their early stages. The fact that every piece of coal burned in it means the destruction of those inimitable molecules spoken of by Lord Cherwell, and means the loss of raw materials upon which our future industrial welfare may depend to an extent as yet unrealised, does not appear to concern the coal trade. In a recent speech Sir Evan Williams extolled this fire and spoke as if the coal fire was one of the eternal necessities. The truth is, surely, that it is a brief interlude between the primitive and the scientific ways of obtaining artificial warmth.

There is something profoundly disquieting about all this. If we can make the effort to detach ourselves and look at it through the distant eye of history, something out of harmony with the general march of scientific progress. The fact that the fire is rather more efficient than the old fires, or that it reduces smoke, is irrelevant. The fact that matters is that instead of the coal industry leading the way to the approaching era—the neotechnic era in the world of fuel—it seems to be throwing out an anchor back to the past. Research, in the year 1944, on an improved type of coal fire, is rather like research on an improved type of stage-coach.

THE BENLLECH HEARTH



We have been asked by readers to illustrate the Benllech Hearth, which was described in our last but one issue (Summer, 1943). The above diagram will make clear the construction of this new open fire.

A Defence of Raw Coal

SINCE the above article was written we have received a recent paper by Mr. J. C. Bennett, Director of the British Coal Utilisation Research Association, which in many ways reads like a direct reply to our criticisms of his Association's raw coal predilections. Mr. Bennett maintains that coal conservation will be better served by the use of coal in new types of open fire that will "as an ultimate target" have an efficiency of 45 per cent, rather than by the use of gas fires or electric heating. He does not, however, think that the use of gas or electricity will decline, because of their convenience. He also states that there are better ways

of obtaining the chemicals from coal than by carbonising it, and it seems, he says, "that it would be more intelligent to burn 95 tons of coal in the raw state and convert 5 tons into chemicals than to carbonise 100 tons and lose 36 per cent.—or at best 20 per cent.—to make only one ton of chemicals." He agrees that smoke abatement is an urgent national problem, "but the natural way to solve this problem is to burn coal without making smoke and not to waste a lot of coal in making smokeless fuels."

We hope to return to this provocative paper in a more detailed way in our next issue—with, perhaps, a reply to our own article from a coal trade spokesman.

“ATTACK” CREATES A STIR

Some Comments and Discussions on the Question of Funds

THE article on the Society's income and the urgent need for raising it to the region of £10,000 a year, has caused more interest than we had dared to hope for. And not only interest: there have already been some increases in subscriptions—including some “ten-fold” increases—as was tentatively suggested—and a number of special donations. It is a most stimulating response, and encourages us to go straight ahead with a more formal appeal.

One or two members have asked us to indicate how we would expend the £10,000 a year we have been talking about, and how this would show the improved percentage of “creative” to “basic” expenditure that was discussed. For any readers who missed the article it may be explained that we showed that with an income of £1,000 about £900 had perforce to be spent on such basic items as salaries, rent, and other expenses needed simply to keep the Society going and in good trim. With £5,000 a year it was suggested that 50 per cent., and not 10 per cent. would be available for distinctive creative expenditure. With £10,000 a year this might reach even 70 per cent. It is very difficult to work out a satisfactory statement of expenditure, because so much will depend upon the way opportunities and needs develop as the income rises towards the higher level. But as an *example* of what it might be, the following figures are, with some hesitation, given:

Salaries (H.Q. staff of six) ...	£ 2,000
Rent, general expenses, travelling, etc. ...	1,000
Publications and general printing ...	2,000
Exhibitions ...	1,000
Publicity and advertising ...	1,000
Films ...	500
Special educational work (schools, etc.) ...	750
Lecturers, branch organisations, etc. ...	750
Investigations ...	1,000
Total ...	10,000

The amount estimated for salaries might well be insufficient, as it is possible that six would be too small a staff. In any case, some of the money allocated to the purposes listed would be required for salaries or fees—an exhibitions organiser or secretary, for example. All expenditure goes back to payment for labour in the long run, and in such an estimate it is a question of deciding how far back to place it. Some of the items obviously overlap in this simple analysis—education and publications, for instance. The items for Films is intended to cover a year's contribution to the capital cost of preparing films and the current expense of arranging exhibitions. We must, however, stress that all the figures are quite conjectural and must not be taken as estimates.

Press Comment

We should like to quote from two editorials that appeared in the Press as a result of our article. First, from *Gas Journal*:

“The importance of the subject fully warrants our repeated references to the smoke problem, and in particular to the work of the Smoke Abatement Society—work which has been marked more by enthusiasm than by affluence. The gas industry and many gas undertakings have, of course, continuously supported its activities, but when all is said and done the Society's high-peak income just before the war was only the modest sum of £1,200 a year—wholly inadequate for a campaign sufficiently large or intensive to kindle public opinion, absurdly inadequate when one considers that out of this sum the Society has to be kept in being . . . If ten thousand is over-optimistic and wide of possibility, at least the germ of the idea appears to us to be sound enough, and we think that if the Society's financial position as it stands to-day was more widely known and appreciated, the ratio of which we have spoken would be reversed.”

Secondly, *Municipal Engineering and Sanitary Record* wrote:

“ . . . It is asked, why not a ‘Ten-Fold Plan’? The suggestion is cer-

tainly an attractive one, and has sound sense to recommend it . . . Not for one moment is it to be expected that such hopes will be realised, but there is nothing like striking high, and once get such a plan into working order there is no saying where it will end. Anyway, the suggestion meets with our highest commendation, and we wish it most cordially the success it deserves. There are few societies engaged in work of a more important nature, and it cannot be said that the general public has risen to the occasion as it should (and could) have done."

Members' Comment

We invited some of our members to give us their views on the article "Attack" and from these some interesting quotations can be made. To prevent restraint and encourage frank speaking, we promised not to publish the names of the writers—a case of "no name, no pack-drill" on this occasion.

* * *

"Cast thy bread upon the waters" is the Biblical injunction. £10,000 a year would be a mere bagatelle for advertising in Big Business, but your critics may be inclined to suggest that it is a lot of money to float—or sink—in propaganda for Smoke Abatement. This is Big Business. The returns envisaged are millions of pounds now lost in waste of fuel and in the destruction of materials caused by the products of this waste. And who dare estimate in terms of money the loss of life, particularly infant life, and the damage caused to thousands of lungs by the needless smoke and fog of our towns and cities? Should we attack? We must attack. How shall we attack? "Cast thy bread upon the waters."

C.M.B.

* * *

'No one, surely, who has read *Smokeless Air* in the last two or three years could accept the suggestion that the Society is "in a comatose condition." Your analysis supports the view that the most effective course is to direct the bulk of your propaganda towards influencing the minority "who read and think and have social consciences." Among these the most influential are probably City Councillors and such Chief Officials as the Surveyor, Architect and Director of Housing employed

by such Councils. All these might be directly approached with a view to persuading Town Councils to increase corporate subscriptions to the Society.

Until the end of the war in Europe eases the strain on private purses it seems doubtful whether many of the present private members can be expected to make substantial increases in their subscriptions; but an intensive campaign for further contributions from existing social institutions might be effective.

You do not, in your article, stress one of the most hopeful features in the present coal shortage—the fact that the nation is becoming increasingly conscious of the economic sin of the inefficient burning of unprocessed coal. Is it too much to hope that an enlightened national (i.e. Government) policy in this respect will, operating side by side with your "£10,000 a year" propaganda campaign, go a long way towards reaching the desired objective?—*Potential*.

* * *

To call upon firms and private individuals for further support would, I think, result in a disappointing response. The Society's subscription list shows that many municipalities are interested in our work but their subscriptions are extremely small. The interest in town planning, in which a clean atmosphere would play such a great part, justifies a far greater support in the future from municipalities than has been given us in the past.—*R.H.C.*

* * *

The increase of our membership is of vital importance.

The wisdom of our cause for the common good is overwhelmingly proved, just as the need for the abolition of slavery was last century, yet until Wilberforce and Buxton realised that progress in a democracy is dependent on numbers, and enrolled 40,000 supporters, slavery was permitted to continue.

Let us go out for a similar increase in membership (possibly associate members), pledged to fight our battle. Let all members be asked to enrol other members in their areas.

Only numbers can sway public opinion, and only enlightened public opinion can give us sunlight for all.—

J.G.

The little that one individual can do either by subscription or burning smokeless fuel has only a minute effect and the benefit is spread over so wide a field that one feels discouraged; the incentive is so weak. On the other hand the local authorities who represent large numbers of individuals can act both by suitable byelaws and by subscriptions on behalf of their rate-payers and I would recommend the strongest approach to such bodies for substantial support.

The amount for which you are asking is relatively small and cities such as Birmingham, Glasgow, Manchester and Liverpool should be asked for at least £100 per annum each. If the appeal could be backed by the blessing of Lord Woolton it would carry more weight.—*W.T.*

* * *

Your article "Attack and the Means for Attack" clearly shows a state of affairs which calls for a speedy improvement, and I think that this improvement is to be sought in two directions. On the one hand, the affiliation of only 155 local authorities out of the thousands mention in "The Municipal Year Book" indicates that there is an enormous number of potential members whose interest should easily be gained, if they were made to realise that the Society's activities serve to benefit them. On the other hand, there should be no difficulty in inducing those corporate members who are either manufacturers or distributors of any kind of smokeless fuel, as well as manufacturers of and traders in appliances using smokeless fuel, to make substantial contributions for a purpose at least as valuable as a good-will advertisement. In order to gain their support, however, the Society would certainly have to furnish a detailed plan of action, with figures of how the money is to be used and how a gradual decrease in the burning of raw coal would further their interests.—*Town-dweller.*

(The affiliated local authorities are relatively small in number, but they include most of the larger towns and cities and represent about one-third of the total population of Great Britain.—Ed.)

* * *

What you ask for is not so much a plan of attack as "the ways and means." I suggest, however, that if you produce

the former the latter will follow as a matter of course. Everybody is getting tired of a situation which shows very little sign of improvement, notwithstanding all the efforts that have been made, the breath that has been expended and the ink that has been spilt during the last 30 years. If progress is to be made the monster must be grasped firmly with both hands and squeezed until dead. Methods of gentle pressure, even though persistently applied, are not going to produce the results desired: they have failed in the past and they will fail again. Take the people into your confidence, tell them what you think ought to be done, convince them of the folly of squandering such a valuable treasure as coal, as well as of the crime of producing smoke to the hurt and detriment of all things beautiful, living as well as dead, including man himself, and you will secure their whole-hearted support in the campaign against the evil. There is no other way.—*J.*

(It is the money to buy the pabulum to give us the strength to exert the squeeze that is worrying us.—Ed.)

* * *

Prepare a detailed programme of work based on an assumed income for the next three years of £10,000 per year. Send this to your subscribers' with an intimation of the amount you require from each to reach an income of, say, half as much again, i.e. £15,000 per annum.

If your programme seems well designed for its purpose, I, for one, would be willing seriously to consider recommending to my Company that they should subscribe the desired amount, provided that a sufficient number of similar promises were obtained to enable the £10,000 figure to be reached.

As for the work itself; there will be a number of "satellite" towns built after the war—if one enlightened municipality about to embark on such a scheme could be persuaded to seek Parliamentary powers to forbid absolutely the combustion of raw coal in that satellite town, this would give a lead of enormous importance and value to the movement.

Here, I suggest, is an opportunity to concentrate effort on one limited objective, thus largely overcoming the difficulties of restricted funds.—*E.C.*

The inspired article which appeared in the last issue of *Smokeless Air* has given us much room for thought and increased our doubts and fears with regard to the future.

Why should a problem as important as living *clean healthy lives* have to rely on the generosity of any section of the community for its right to make progress?

We are about to embark upon a campaign of reconstruction in order to give a reasonable heritage to our children and grandchildren and the issue should not be left in doubt, for the sake of financial assistance.

The author deals with "Mass Opinion," "Informed Opinion" and concludes with assistance from "Local Authorities," but it would appear that the correct application should be reversed. This movement should be sponsored and assisted by the Government from the Department of Scientific and Industrial Research, in co-operation with the Ministry of Health. It should be seconded and supported by *all* Local Authorities who are responsible for the health and comfort of their people.

Reviewing the financial support that has been given, it is a reproach to the Government and to every Local Authority in Great Britain that such a movement has to rely on the generosity of industrial undertakings to survive and carry on.—"*But Britain can be Clean Again.*"

* * *

The difficulty facing the National Smoke Abatement Society lies in the fact that not everyone believes in it nor helps it. As regards the former, whereas its meetings of enthusiasts at regular intervals are greatly concerned about what it does, the mass of people outside its influence are apathetic. For every person interested in smoke abatement, there are 999 who do not care unless they happen to be near a chimney which annoys them.

As regards assistance, it is manifestly unfair to levy a tenfold increase from those local authorities who subscribe, leaving out many who don't.

Regarding a solution to the problem, the former can be met by a massive increase in poster propaganda, and as regards the latter by the aims and objects of the Society being those of the Ministry of Health and sponsored by them.

There has been an increase of circulars from the Ministry during the war and one additional one will not be a terrible burden; if the Ministry of Health ask local authorities to report to them after a sufficient interval as to what steps they are taking, and are prepared to take in the interest of smoke abatement—then every local authority in the country will have to respond. Further, if the Ministry recognise contributions to the Society as ranking for grant, every local authority in the country will become smoke abatement conscious.—*A.S.H.*

* * *

Everybody agrees that smoke's a nuisance: why don't they support us in their thousands? Because they doubt whether we have *practical* solutions to offer, that is, smokeless methods which are both widely acceptable and generally economical. Smokelessness which costs the industrialist much more than its prestige value, or methods which would deprive the average citizen of his open living room fire are hopeless in our generation. Convince the industrialist that smokelessness pays *him*, persuade the citizen that he can both have his coke and heat it on a cheery open fire, and we may get somewhere as a popular movement. If we offer the goods people want, they may come to us. If we don't, they won't—and why should they?—*J.P.*

* * *

The critical hour has come.

Attack—indeed *assault* is vital right now if we are to achieve dynamic initiation of smoke abatement.

What of the means?

Private members cannot easily increase their subscriptions these days. Ask us for an extra effort that we may seize this great opportunity. Ask us to covenant our donations and the amount will be doubled by recovery of tax.

Gas, electricity and allied undertakings will benefit enormously from our success and should now begin to support us realistically. Action costs more than discussion, the Society should write asking specifically for sums of £50—£100—£500—£1,000 from these members according to their ability to support: these sums are bagatelles to many of our members, they should be charged to their publicity account.—

G.W.S.

A Rather Frivolous
Forecast—but there is
a Moral.

How the Smoke Problem Ended

Selections from a Diary of the Post-War Years

1944—NSAS makes an appeal for an income of £10,000 a year. This is successful and a powerful campaign for smoke prevention is started. Results are most satisfactory and hundreds of new members are enrolled, including Mr. Nugh Broome, M.P.

1945—Reconstruction begins, preceded by a General Election. A new Government formed, and Mr. Nugh Broome becomes Prime Minister. In a broadcast to the nation he promises to sweep clean, and includes a clean sweep of smoke in his programme. First step in a determined policy for smokeless air is the setting up of a Fuel Utilisation Standards Section (FUSS) of the Ministry of Fuel, with regional and local organisation, for vetting all proposed fuel-burning installations. Sharp controversy in Parliament and Press about the new requirements for higher heating standards and smokeless appliances in all new housing. Mr. Broome achieves a notable compromise under which all open fires and other domestic appliances shall be suitable for smokeless fuels, but the use of such fuels shall not be obligatory unless they are available. He immediately appoints a Fuel Production Development Committee, representing all the fuel and power industries, to submit a co-ordinated development policy as part of the new National Fuel, Power and Coal Conservation Plan.

1946—FUSS in full operation throughout the country. It is discovered that new plant approved and installed is being operated smokelessly. Under the new Town and Country Planning Act smokeless central areas may be set up, and during the year seven of the principal cities establish such zones. Manchester's claim to be first in the field is hotly contested by Bristol. The Royal Observatory at last finds a

suitable site away from London's smoke, and prepares to move. Public agitation in Greenwich against this evacuation: demands made for the whole of the Borough to be declared as smokeless zone at once.

1947—Increasing flow of smokeless fuels from new and enlarged carbonisation plants, increased output from South Wales mines for the home market, and opening of new electrical generating stations, begins to catch up with the growing demands of new housing and other building. Increasing demand for goods of all kinds for home consumption and exports leads to an inquiry into the general efficiency of industry, and the setting up of Industrial Techniques Modernisation Administration (ITMA) under the Board of Trade. Starts by replacing, with the aid of loans or grants, obsolete fuel-burning plant in consultation with FUSS.

1948—Many more smokeless zones set up. Growing popularity of smokeless appliances and fuels by a public now aware of what is starting to happen, leads to a strict control of distribution, priority being given to new and reconditioned housing. Atmospheric Pollution Committee reports a general fall in soot-deposits and acid pollution throughout the country.

1949—Conditions in and near to new and rebuilt areas, and in smokeless zones, now noticeably cleaner. Public and local authorities demand facilities for replacing open fires, etc., in pre-war houses, but the Government insists that new housing shall still have priority.

1950—General improvement in conditions again noted. The soap, paint, and laundry industries get together about the threat of declining trade.

Public appreciation of clean conditions and modern methods of heating continues to grow, and NSAS membership list shows that nothing succeeds like success. Black market in smokeless fuels and appliances discovered.

1951—Reconstruction begins to ease off, and the first signs of possible slump and unemployment appear. Broome announces great National Development Plans that will provide full employment for at least twenty years. These include a "Ten Year Plan" for complete smokelessness. Each town is to extend its initial smokeless zone by at least one-tenth of the remaining area each year. Other projects include railway electrification, Severn Barrage scheme, and complete modernisation of steel and pottery industries—all of which will assist the new national enthusiasm for clean air.

1952—Main line railway electrification programme well under way. Steel manufacturers announce that smoke is no longer necessary and that they can prevent it without government interference. Rejoicings in Sheffield.

1953—Ten Year Plan gathers momentum and generally is well ahead of schedule. Mass Observation reports a new saying from many parts of the country: "You'd wonder where all the dirt has gone to!"

1954—Leeds reports completion of one-half of its Ten Year Plan. Keen competition develops as to which shall be the first smokeless city. National Smoke Abatement Society restricts its membership list owing to excess of income.

1955—Soot deposit figures less than half those for 1945. Minister of Civil Aviation states that cleaner air has helped the development of civil aviation tremendously. "Continental and American pilots no longer grumble at having to grope their way over Britain."

1956—Railway electrification completed. Great influx of overseas visitors to see Britain. "Precious Jewel Recovers Lustre" is the headline of an article in the *Chicago Tribune* extolling Britain as a vacation heaven.

1957—Forty towns and cities announce complete abolition of smoke. Soap, paint and laundry industries comment

upon rising standards of colour and cleanliness, creating a boom in their trades. Lengthy correspondence in *The Times* on recollections of what are beginning to be called "the dingy days." Manchester plants permanent rhododendrons in Albert Square. Sheffield starts advertising itself as a health resort. Parliament votes pensions to the few surviving chimney sweeps. Coal trade is enjoying unaccustomed prosperity. Smaller number of miners now employed, but greater volume of employment than ever before in all mining areas thanks to development of important new industries based on coal processing.

1958—Ministry of Health report shows a remarkable decline in the incidence of respiratory diseases and rise in the general level of health: attributed to abolition of slums and smoke. Ministry of Agriculture reports a marked increase in agricultural productivity around all the main centres of population and even in remote districts. Higher standards of air-consciousness lead to increasing complaints about vehicular fumes and the motor industry produces from up its sleeve a method for their purification.

1959—Complete smokelessness in all large towns. Gas and electricity are now available for all but the most isolated rural homes, and smokeless fuels are now made obligatory everywhere. Raw coal burned only in "Class A" industrial installations under strict licence from the Ministry of Fuel. The products derived from coal processing, including remarkable new plastics and fuels for jet-planes, now constitute a major proportion of Britain's growing exports. Broome receives the freedom of sixteen towns as a sign of appreciation for his work in "bringing country air to our doorsteps," as eloquently expressed by the Lord Mayor of Birmingham.

1960—Britain clear of smoke and fumes. U.S. Veterans of the Greater War pay a "reunion" visit in force, and 50,000 decide they don't want to go home again this time. Royal Observatory returns to Greenwich. National Smoke Abatement Society is wound up and its secretary takes an appointment as gardener in the new apple orchard in the Strand.

DISTRICT HEATING IN BRISTOL

A Preliminary Report

FOLLOWING the destruction wrought by enemy action in Bristol in 1940-41, the City's Public Works Committee accepted an offer made by Messrs. Arthur Scull & Son, Ltd., Engineers, of Bristol and London, to investigate the application of a "Heat Distributing Service" for the Central District of the City, with regard to its suitability and economy, and to submit a report on the subject. The scope of the proposed report was to cover a complete survey of:—

1. (a) The whole field of domestic heating and hot water supply as applied to commercial buildings, large community dwellings, and institutions ;
- (b) The provision of bulk heat from a central source and its distribution to the Central District of the City of Bristol.

2. The financial and economic aspects of such a project as outlined under 1(b).

3. The public amenity value of such a project.

4. The probable effects of such a project if developed in relation to other utility undertakings, providing direct or convertible sources of heat energy.

5. The administration and management of such a project and the necessary statutory powers required to operate the undertaking.

After 18 months of intensive research, the Company submitted a comprehensive preliminary report on the subject to the Town Clerk of Bristol in January, 1943.

The Company's report deals in the main with the supply of bulk heat energy for domestic heating and hot water supply, as the area covered by the project is likely to be mainly commercial in character as distinct from industrial. There is, however, nothing to preclude the extension of the project to industrial districts.

The Scheme in Outline

The following is a general outline of the proposed scheme:—

- (a) The area suggested to be brought within the scope of the town heating scheme covers approximately 345 acres of the central part of the City of Bristol.

- (b) The estimated quantity of heat required for this area is 12,000,000 therms, annually.

- (c) The generation of this required quantity of heat would be effected by the combustion of coal in highly efficient steam-raising boilers, situated in one central combined electric power and heat producing station, located for preference adjacent to the City's waterways and railway system to facilitate coal transport, etc.

The steam raised in the central station would generate in passout turbines primary electricity, which would be available for general consumption, and the heat content of the passout steam for the turbines would be used for the heat distribution service.

- (d) The anticipated consumption of coal in the combined electric power and heat producing plant is estimated to be 77,500 tons per year ; a figure to be compared with the 100,000 tons of coal which it is calculated would be consumed by individual heating units in the same area in the same period of time.

- (e) The distribution of the produced heat energy to the user would be through tubes of welded steel construction, suitably insulated, housed in reinforced concrete ducts, constructed below the street surface. As the carrying medium, high pressure hot water and not steam is suggested, the former having many distinct advantages over the latter. Branch connections from the trunk mains to sub-stations, located to control a group or groups of buildings would be made. Individual buildings or users would have their supply metered to them from the sub-station, utilising the energy in the various already known forms of central heating, air conditioning, hot water supply, etc., according to their in-

dividual requirements, dispensing with the local individual boiler house, with its many attendant disadvantages.

(f) The distribution of the proposed electrical energy, some 25,000 kilowatts, would be through the necessary switch-gear to a Corporation Electricity Department's Distributing Station, possibly direct to the existing switch rooms of the Feeder Road Power Station. The electrical generating capacity of the proposed new combined heat and power plant approximates to that of Feeder Road and might, if desirable, ultimately relieve that Station entirely of its present load.

(g) The period of time required to complete the whole undertaking is dependent entirely on two factors:—

- (i) the progress of general building reconstruction in the area; and
- (ii) the demand for the energy.

It can only remain an assumption that there would be an almost universal demand within the area for the new cheap and clean form of heat energy, and that, therefore, the undertaking

would be developed in stages, reaching anticipated completion and working to full capacity of output within 17 years of its inception.

It is estimated that the capital cost of the whole undertaking, including preliminary and loan expenses, would amount to £1,550,000, values being based upon commodity prices ruling at June, 1939. The cost of the heat would be just over 4½d. a therm, and it is claimed that this price is relatively cheaper than any other form of heat at present available in the City, with the exception of the individual direct central heating installation and the slow combustion stove. It is contended that the adoption of the scheme would eliminate hundreds of smoke-emitting chimneys and in so doing would save the fabric of city buildings from smoke erosion. Street coal delivery traffic with its attendant dirt and dust would also be eliminated. Town heating has operated with considerable success both in America and on the Continent of Europe.

MERSEYSIDE CIVIC SOCIETY

THE Liverpool Civic Society, which has a Smoke Abatement Sub-Committee, recently passed the following resolution, which was sent to the Town Clerks of the Merseyside Local Authorities:

"In view of the menace to health and happiness, the harm to vegetation, the discoloration and damage to buildings and the disfiguration of our skies by clouds of smoke, the Merseyside Civic Society hopes that in the replanning of Merseyside every effort will be made to abolish the evils and waste of smoke. The Committee is prepared to submit definite suggestions, if desired, but it feels sure that the expert building authorities are fully alive to the problem.

"The Committee is anxious to help in any way that may be desired by the planning authorities, and in collaboration with the Liverpool Council of Social Service will continue its active campaign against the smoke menace to health and amenities; by lectures, discussion groups and educational propaganda."

Following this the Sub-Committee

considered and adopted a further resolution, which received the approval of the Executive Committee; emphasising the following points as its present policy:

(1) One open fire in the new houses, but the grate to be suitable for using smokeless fuel.

(2) The Civic Society should work in close alliance with the National Smoke Abatement Society.

(3) Proposals should be drawn up setting forth practical steps for ensuring clean air. These to deal with (a) industry, including railways and municipal undertakings, (b) office areas, (c) domestic.

(4) In connection with the proposed Merseyside competition it was felt that opportunity should be sought to get publicity for smoke abatement by repeated interviews with those known to be concerned with this problem.

(5) Agreed that the question of District Heating was economically difficult and should not be stressed at the moment.

We are very pleased to have received this resolution, and appreciate the desire to work in alliance with the NSAS. We hope, in later issues, to be able to report active progress in this direction.

SMOKE PREVENTION

ABSTRACTS

A selection of Abstracts of recent papers and publications of interest.

Acknowledgments are made for those taken from indicated Abstract sources. It is hoped to make this a permanent feature and to extend its scope when paper restrictions are eased.

1. Air Conditioning and Dust Collection (F. Wright, J.Text.Inst., 1943, **34**, 145P). A brief outline is given of some of the general principles involved in the design and selection of air-conditioning and dust-collecting equipment, with particular reference to the requirements of the textile industry.

2. A Portable Electrostatic Precipitator (W. L. Lea, J.Industr.Hyg. Toxicol., 1943, **25**, 152. Sci.Abstr., 1943(B), **46**, 184). Details are given of the construction of an electrostatic precipitator for the sampling of dusts, fumes and other forms of atmospheric contaminations. The sampling head and blower are separate from the self-contained power supply. A list of component parts is given, with instructions for assembly. All parts are standard commercial items but a description is included of methods of carrying out certain modifications, such as the disconnection of primary and secondary of the h.v. coil. Results of tests carried out in a foundry are discussed.

3. Sulphuric Acid from the Smoke of Electric Power Stations (N. Zalogin, Novosti Tekhniki, 1940 (21-22), 46. Khim.Referat.Zhur., 1941, **4**, 74. Chem. Abstr., 1943, **37**, 6413). The flue gases, purified from ash and containing 0.35 per cent. of sulphur dioxide, are scrubbed with water containing magnesium oxide. Hexahydrated magnesium sulphite crystallises out, a part of it being oxidised to anhydrous magnesium sulphate and remaining in solution. The anhydrous magnesium sulphite is decomposed in a rotary furnace at 900 deg. to magnesium oxide for re-use in the process and sulphur dioxide, which is used for the production of sulphuric acid. Magnesium sulphate is recovered from the solution.

4. Area Heating (L. E. C. Hughes, Nature, 1943, **152**, 497). The advantages of district heating by waste-heat from power stations are briefly discussed and it is pointed out that, if carried out on a large scale in large centres of population, district heating would dispose of the necessity for the traditional domestic fire and its consequent wastage of heat into the open sky, pollution of the atmosphere with

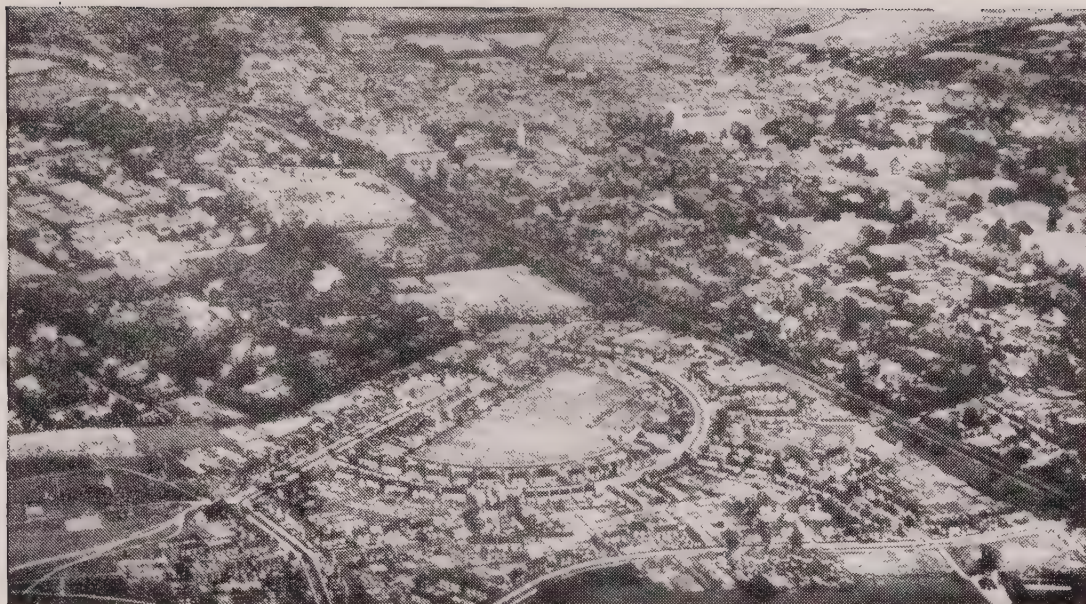
unconsumed carbon, and the wide-scale deterioration of buildings because of the sulphur acids emitted into the atmosphere.

5. The Growth of District Heating in Russia and Germany (A. E. Margolis, Engineering, 1943, **156**, 283). Summarises data published up to 1941. Reference is made to the effect of district heating on atmospheric pollution and the appearance of towns without stacks and chimneys.

6. District Heating Proposals for Coventry (Colliery Guard, 1943, **167**, 588). Coventry City Council received on November 2nd, 1942, a report from the City Redevelopment Committee on a scheme, submitted by a Weybridge firm, to provide central heating for reconstructed business premises in the city centre when rebuilt. It was proposed to convey hot water from the electricity generating station by pipelines to supply a meter service (the water being returned to the station), instead of wasting the heat through cooling towers. The committee pointed out that, because of the distance involved, such a scheme could be operated successfully and economically only by establishing a heating station closely adjacent to the area to be served. The suggestion was deferred for further consideration on those lines.

7. Determination of Small Amounts of Carbon Monoxide in Air and Blood (H. F. Holden, Aust.J.exp.Biol.med.Sci., 1943, **21**, 9. Chem.Abstr., 1943, **37**, 4330). Two types of apparatus, employing tonometers, are described for determining carbon monoxide in samples of air of less than 25 cc. The methods are based on the combination of carbon monoxide with haemoglobin and are sensitive down to one part per 100,000. The second apparatus is also suitable for determining carbon monoxide in blood.

8. Fuel Policy (Coke and Smokeless-Fuel Age, 1944, **6**, 58). A plea is made for the sinking of sectional interests so that a co-ordinated fuel policy may be put into effect, and reference is made to the value of such a policy to the solution of the smoke problem.



Planning for the Future

"Those who have kept house in France, Germany and Switzerland know well that 'English Comfort' is an exploded myth . . . In house construction, heating and sanitation . . . we are behind North America and Scandinavia.

"Now is the time when architects and builders are planning reconstruction—it depends primarily on homes well built, lighted and warmed; well equipped with bath and sanitary arrangements; with a hot water supply constant and regular . . .

"... These are among the basic necessities of civilisation, health, contentment and prosperity and would give us a standard of living which other lands could envy."

A Doctor, in the 'Daily Telegraph.'

The London and Counties Coke Association is planning in line with the future pictured by this Doctor—and for a more efficient use of our National fuel resources. Its engineers and technical experts are constantly investigating new and improved methods of domestic and industrial heating.

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*Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky ;
All bright and glittering in the smokeless air.*

SMOKELESS AIR

London

Progress has been made in London during the last few months. On other pages are reports of the deputation to the Minister of Health, and the Minister's address to the conference of the Greater London Advisory Council for Smoke Abatement. We liked, and fervently endorse, Mr. Willink's hope that the centres of our cities will not be places in which sensible people prefer not to live. Mr. E. H. Keeling, M.C., M.P., is Chairman of the Greater London organisation and a Vice-President of the Society, and we should like to pay tribute to him for the very valuable work he has done recently in bringing smoke prevention before the Ministries and his Parliamentary colleagues.

At the conference in the House of Commons there was discussed the idea of a smokeless central zone for London—to include the City, most of West-

minster, and part of Holborn. The City of London, because of its special character and the severity of its present devastation, is the obvious and most appropriate starting point. St. Paul's can at last be given a worthier setting than it has yet had, and, if the effort is made, it can look over a clean and smoke-free town. In 1700 that Timothy Nourse, writing on the smoke of London, lamented that "the glorious fabric of St. Paul's now building, so stately and beautiful as it is, will after an age or two look old and discoloured before 'tis finished, and may suffer perhaps as much damage by the smoke as the former Temple did by the Fire." We hope that the City of London Corporation, the Livery Companies, and the other important institutions in the City will agree that their proud and ancient territory should—as it very easily can—achieve the honour of being Britain's first smokeless zone.

Scotland

From Scotland there are signs of no progress being made. The comprehensive Report by the Scottish Housing Advisory Committee, "Planning our New Homes" is an important publication, which deals with domestic heating in a generally unprovocative way. In referring to the smoke nuisance caused by the domestic fire it begins excellently and ends up badly. It describes as notorious the gross waste of energy in the use of raw coal and says that it is responsible for at least half of the atmospheric pollution which is so detrimental to healthy and amenity in Scottish cities and burghs. "Reasonable additional expenditure on more efficient heating and cooking appliances which resulted in proportionate economies in fuel consumption and in current expenditure on fuel and facilitated the use of smokeless fuel, would be justifiable in the national interest."

But, the Report unfortunately continues, "the traditional preference for the open coal fire is, however, so strong that we contemplate that houses to be built in future will contain at least one coal fire—in the living room—and that a coal fire will also be demanded in the principal bedroom." The Committee seems to have assumed that the choice to-day is still between the open coal fire and no open fire. It is a pity that the opportunity was not taken for showing how the open fire can be retained and yet made harmless.

Gibraltar

From a friend in Gibraltar comes news that the "Forces Parliament" there has recently been debating the smoke problem and has passed a Smoke Abolition Bill by 32 votes to 15. The "Government" has also set up a committee to consider the quickest means for achieving a smokeless Britain. Our correspondent, who introduced the Bill, adds, "What a pity they are not so progressive at Westminster." It is, by the way, a Common Wealth "Government" in Gibraltar, and we should like to see its parent body in this country also make the abolition of smoke a part of its policy. The Liberal Party did so in effect at its last annual conference, when it passed a resolution on reconstruction which included "the progressive elimination of the smoke

nuisance."

Many members of the Conservative and Labour parties are active protagonists for smoke prevention. Is it not time that they should induce their organisations to come in officially on the side of clean air?

Index to Smokeless Air

It has never seemed to be necessary to publish an annual index for a quarterly publication as slender as *Smokeless Air* or its predecessor *The Journal*. And yet over the period of thirteen years it is remarkable how the list of contents has mounted. For office reference a cumulative index has been prepared for volumes 1 to 13, which includes nearly 500 items. It might be possible either to print or duplicate this index if a sufficient number of readers wished to have copies. Will those interested please write to the Secretary, so that the possible demand may be gauged?

The Appeal

We are waiting only for a favourable moment, when attention can reasonably be diverted from more momentous affairs, to start our appeal for an annual income much bigger than that with which we have hitherto hobbled along. A short appeal leaflet—short and rather cramped because of the paper restrictions for such purposes—has been prepared and will be sent to all members in due course. We believe individual members may in many cases find it possible to increase their contributions, and from our corporate members of all kinds we hope, not without some justification, for a really big response. The appeal leaflet quotes a remark made about the Society: "Never has so much been done for so many on so little." It is a pleasant tribute, but it makes us more anxious than ever to show what we can do with a little more.

Through the Tunnel

From the *Yorkshire Evening Post* we cull the following comment sent in by a reader: "Conversation was animated in our compartment between Harrogate and Leeds to-day, for we were telling each other how much more agreeable our daily journey would be if the area near the River Aire should actually become smokeless."

"As the train speeds across Wharfedale these spring mornings, the view is one of fresh, green pastures and ploughed fields separated by blossoming hedges, through which the river winds its way. But at Arthington, the long dark tunnel engulfs us, and when we emerge there is little to brighten our ideas. Grey roofs replace the green fields, and a grey-brown haze matches the dinginess of the surroundings. The tunnel is like a dark curtain marking the end of one lovely scene and the beginning of a grim and forbidding one."

Smoke Reduction in the Coal Fire

Mr. R. H. Rows, B.Sc., F.Inst.P., has published a note on some experiments at the Fuel Research Station of the Department of Scientific and Industrial Research on the reduction of smoke from the domestic open coal fire. It is pointed out that in order completely to burn smoke there must be an intimate mixing of the smoke and air necessary for combustion at a sufficiently high temperature. This can only be achieved in the open fire if other necessary characteristics essential to domestic appliances are retained—particularly ease and simplicity of operation, robustness of structure, simplicity of design and ability to work under all the diverse conditions to which such appliances may be subjected. An arrangement should also need no manipulation whatever, and peculiar structural features should be avoided.

As a result of the work carried out at the Fuel Research Station an arrangement for reducing the emission of smoke from domestic coal burning appliances has reached an advanced stage of development. In an appliance to which the arrangement is applied the fire brick back rises from the level

of the fire bars, and at a suitable height above the fire-bed the fire brick structure is turned out roughly at right angles towards the front, thus forming a roof which extends almost to the outer edge of the appliance; the outer edge of the roof is turned downwards a few inches thus forming a kind of open combustion chamber. The partially burnt smoke-laden gases rise from the fire-bed and pass into the combustion chamber, where by virtue of its shape they are intimately mixed with the air required for combustion at a temperature sufficiently high to ensure that they ignite and burn. The gases pass out under the front of the combustion chamber and thence into the flue. The combustion chamber is kept hot both by the gases burning in it and by the heat radiated to it from the hot fuel in the grate.

Although the device is designed to reduce the amount of smoke given off by coal when burned in domestic appliances it should not in any way reduce the efficiency of the appliance when smokeless fuels are used.

The weight of smoke given off from an ordinary open fire varies in general between 1 and 3 per cent. of that of the coal, the actual quantity depending upon many factors such as the quality and size of the coal, the method of refuelling, the intensity of the fire, the design of the grate, and the time for which the fire has been in use. In a grate fitted as described the amount of smoke varies between $\frac{1}{2}$ and 1 per cent. of the weight of fuel burned. Because of the many variable factors already mentioned it is not possible to give in precise terms the amount by which smoke is reduced by using this or in fact by using any smoke reducing arrangement. Comparative tests, however, show that with the device in its present state of development the reduction in smoke emission is up to 50 per cent. or sometimes more.

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Smoke Prevention in New Housing

Deputation to the Minister of Health

THE most urgent problem facing the smoke abatement movement at present is whether the new houses to be erected after the war in very large numbers are to be smokeless or not. If they are not smokeless and if they cannot be made smokeless at a later date without changing their original equipment, then the domestic smoke nuisance will be both extended and perpetuated. What the Society would like to be done is that the new homes should be fitted with suitable appliances and that there should be regulations to prevent the emission of smoke. It is, however, not practical politics at the moment to demand measures for the prohibition of domestic smoke from either existing or new houses, and no useful purpose can be served by demanding them. What is practical politics, however, is to urge that the appliances installed in new houses, and open grates in particular, should be suitable for the use of all forms of smokeless fuel as well as raw coal. There should be the *provision* in all new houses for complete smokelessness, even though it may not at first be possible to ensure it. If grates suitable only for coal are installed the householder who wishes to use smokeless fuel—and the number is growing—would be effectively barred from the “freedom of choice” that is to-day often demanded.

This is the immediate objective of the smoke abatement movement. Following a question by Mr. E. H. Keeling, M.C., M.P., in the House of Commons on the open grate to be installed in demonstration houses (see our last issue) a memorandum on domestic smoke prevention was submitted to Government departments on behalf of the Society and the Greater London Advisory Council for Smoke Abatement. The Minister of Health (Mr. H. U. Willink) received a deputation from the two organisations, which was supported by a representative of

the Council for the Preservation of Rural England—which is anxious to prevent a further spread of the smoke nuisance into the countryside. With Mr. Willink were the Parliamentary Secretary of the Ministry of Fuel and Power and representatives of the Ministries of Works and Town and Country Planning.

Mr. Keeling, Chairman of the Greater London Advisory Council, and Mr. Charles Gandy, Chairman of the Society's Executive Committee, said that the crux of the problem was the living-room fire. The Government should specify and demonstrate efficient grates. Grates in which smokeless fuel could be burned or ordinary coal burned smokelessly should be made compulsory in all new houses. If an adequate supply of smokeless fuel was not at first available, ordinary coal could equally well be burned in such grates. The need of adequate supplies of coke and other smokeless fuel dovetailed in with the urgent national interest that our coal reserves should be conserved, their economic use developed and the consumption of raw coal reduced. The possibilities of central heating and district heating should also be examined.

In reply Mr. Willink said that the subject was one which was of very great importance from the point of view both of health and amenity. It was a question of practical ways and means of achieving this objective. He would welcome any specific suggestions from the Society and the Council.

Mr. Tom Smith said that quite apart from smoke prevention his Ministry was keenly interested in the efficient use of fuel and would do its utmost in that direction.

Since this deputation further conversations have been held with representatives of the Government and, as reported on another page, Mr. Willink at the conference of the Greater London Council indicated that in a



E. H. Keeling, M.C., M.P.

Manual of recommendations on housing to be published in the near future by his Ministry it was hoped that it would be possible to give the latest information on smoke prevention methods.

Although it is yet too early to make any definite statement it may be said that there are reasonable grounds for hoping that the proposals put forward will be accepted. If this is so it will be an advance of the greatest importance. It will not in itself bring smokelessness, but it will create the essential conditions for it.

At a later date it is hoped that it may also be possible to report other important steps forward.

COAL

*The Editor,
"Smokeless Air."*

Sir,

In making some comments on the article on "Coal" in your spring number I will not impinge on the promised review of Mr. J. G. Bennett's paper, nor will I do more than take passing note of the remarkable extension of the objects of the Smoke Abatement Society, as revealed in the article.

For the sake of brevity and ease of reference I will set out my comments in a series of numbered paragraphs as follows:—

- (1) The coal industry agrees that "coal must be regarded in a new light and that we can no longer afford to burn it in the old

wasteful ways." The British Coal Utilisation Research Association and the Coal Utilisation Joint Council have been established to give practical effect to those very ideals.

- (2) BUT the coal industry does not subscribe to the theory that the only fuels of the future will be gas and oil—there is, curiously enough, no reference to electricity in your article.
- (3) AND the coal industry thinks that even in these days, there is still something to be said for giving the people of this country what they want. And one of the things that they unquestionably want in their post-war houses is an open fire. This has been confirmed by every survey of opinion that has been made both in the Services and among workers at home. The preferences and, incidentally, the pockets of the people of this country, cannot and should not be completely ignored.
- (4) It is not, at present at any rate, proved that *all* coal can be economically turned into gas or oil, even using the word "economically" in its widest sense.
- (5) As regards production of valuable chemicals, it is no longer true to suggest that the most economical way of obtaining these from oil is necessarily by carbonising it.
- (6) The coal industry, therefore, while pressing forward with its longer-term plans for research—including as a most important item research into practical and economic methods of extracting directly the valuable products contained in raw coal, and for the most efficient and economical utilisation of coal when used for the generation of heat and power, feels that it is not only supplying a public need but fulfilling a public duty in endeavouring to perfect the open coal fire.
- (7) The improved open fire (which can also be used closed) that is the subject of your criticism will burn any kind of solid fuel—including coke and semi-coke.

Yours faithfully,

H. J. GILLESPIE.

THE MINISTER OF HEALTH ON SMOKE ABATEMENT

Greater London Advisory Council Conference

THE Greater London Advisory Council for Smoke Abatement, which is one of the advisory regional committees of local authorities, was formed in 1938, and had only just got into its stride when the war put a temporary stop to its progress. It has now restarted its work and made a very successful beginning with a conference and general meeting held in the House of Commons on May 8th. The meeting was attended by representatives from 67 of the Greater London authorities.

Mr. E. H. Keeling, M.C., M.P., was re-elected Chairman and Mr. C. W. Gibson, L.C.C., Vice - Chairman. Dr. A. J. Shinnie, Medical Officer of Health for Westminster, was elected Hon. Treasurer, and Mr. Arnold Marsh re-elected as Secretary.

The Conference which followed the business meeting was on "Post-War Smoke Prevention in Greater London" and was opened with an introductory address by Mr. H. U. Willink, M.P., Minister of Health.

Mr. Willink said that great areas of London would not look as obsolescent as they do if it were not for the smoke of the past and present. He reminded the Conference that the Government had not been inactive, and that between 1919 and 1923 there was an improvement of about 50 per cent. in the soot deposit dropped on London. Then there was a stationary period and some deterioration, but between 1935 and 1939 there was again some improvement. Pointing to the fact that after the war there would be a limited supply of natural smokeless fuel, Mr. Willink referred to the most recent trend in regard to fuel economy, saying that the direction in which one hoped for progress was in the manufacture of a really satisfactory improved grate which would burn raw coal more completely and would also burn smokeless fuels satisfactorily. There was no escaping the fact that the British public liked an open fire

and what they had to achieve was a fire which would be equally attractive, was economic, and would not need continuous watching. From all the expert opinion he could get it would not seem that research in this direction had yet reached finality. The departments concerned were very interested in the matter and there was every reason why they should be because the loss of all kinds due to smoke was very great indeed. The building in which they were meeting had suffered terribly from atmospheric pollution.

Mr. Willink said he was very glad to find a revival of activity both on the part of the Greater London Advisory Council and the National Smoke Abatement Society, and the realisation of the fact that this was now the time to move. He hoped their campaign would go ahead. He would be glad to do what he could in the field of research and in collaboration with the Ministry of Works and the right sort of standardisation.

The Minister continued that his Ministry, together with the Ministry of Works and the Ministry of Fuel and Power were agreed that there should be efficient domestic heating appliances and practical methods of smoke prevention. During the summer the Ministry of Works would issue a housing manual in which the latest available knowledge on the subject would be given.

"I am anxious," concluded Mr. Willink, "that we should do all we can not only to have less smoke in our new housing estates in the suburbs, but that we should not run the risk of spoiling the hearts of our cities by making them places where sensible people would prefer not to live."

Domestic Smoke

In a paper on "Smoke Prevention in New Housing," Mr. H. T. Perry, Chief Inspector, Kingston-upon-Thames, asked if we could make smokeless the houses to be built

immediately after the war by forbidding the use of bituminous coal in the ordinary open fireplace. We could do so provided we had the co-operation of the people who will live in the new houses, but there was a tremendous prejudice against the abolition of the coal-burning open fire. Its good features could not be denied but what was there on the other side of the balance sheet? "What about the efficiency of the ordinary open fire?" asked Mr. Perry. "It is stated to vary from 15 to 20 per cent. If this be so, then out of each ton of coal consumed the heat produced by at least 16 cwt. is lost—mostly up the chimney. What about the pollution produced by this inefficient method of burning coal? According to the quality of the coal, and whether it is washed or not, varying amounts of soot, tar, sulphur, and flue gases are produced and these are poured into the atmosphere. There can be little doubt that, upon reflection, even strong supporters of the open coal fire would find their arguments weakened and they could not resist the logical conclusion that it must be abolished as soon as possible."

Mr. Perry further considered the question of waste and pointed out that the annual saving in the value of coal consumed would more than balance the interest and repayment charges on the extra cost, if any, of an efficient firegrate.

He suggested that the first and obvious thing was to instal a grate capable of burning smokeless, as well as ordinary fuel; and that this could be used to burn ordinary house coal until an ample supply of smokeless fuel was made available. New types of such grates were available for post-war housing and had increased efficiency. As with other new types of grate, reliance need not be placed solely upon radiation, and supplementary warming could be achieved by means of convection currents—means for an air supply to be carried round and behind the grate, where it was warmed before entering the room. Alternatively, there were grates which would burn bituminous coal with less smoke. These grates would not be as cheap as the ordinary pre-war models, but against the extra capital cost there would be the inevitable saving in cost

of fuel and lower costs of cleaning and labour.

The amount of fuel used in the house could be reduced by insulation of the building. Walls and ceilings of living rooms should be lined with a non-heat-conducting material. Our ancestors were not without wisdom when they panelled their rooms with wood. Mr. Perry referred to an article by A. F. Dufton (*J.Inst.H. & V.E.*, Jan.-Feb., 1944) giving an account of the effect of panelling a room. Previously the room took an hour and a half to become warm, but after panelling it was equally warm in half an hour. "There is no need," continued Mr. Perry, "for the use of fancy or expensive wood surfaces, and neither is it necessary to have thick linings. A wood fibre lining will prove more effective than a harder ply-wood but the latter would conserve the heat much better than the hard, cold cements and plasters which have been the joy of the speculative builders for many years. The order of merit of insulating lining materials commencing with the most suitable, is as follows: fibre-board, ply-wood, hard-board and plaster-board. There is a further very important aspect of this question of insulation. Apart from the reduction in the amount of fuel needed to warm a lined room, the use of low thermal capacity materials on walls and ceiling will reduce very considerably the frequent occurrence in houses."

The author briefly reviewed the value of district heating and the use of gas and electricity and concluded by saying that the consideration of this important subject should not take the usual form of "passed to you for information or action." It was a matter which should bring the Government departments together in close and frank discussion. It would be difficult to find a more opportune time than when so much new building was to take place, and as for the cost—well, if the extra capital cost was £10 per house (and it was not likely to be as much for a modified arrangement) it would amount to £3,000,000 for the first two years—only about one-fifth of the daily cost to this country of the war. "Strangely enough it is proposed to instal refrigerators in the new houses at what cost I know not, but although the need for refrigeration has been re-

cognised, there appears to have been no imagination brought to bear on the subject of heating."

Industrial Smoke

"Industrial Smoke, the Council, and the Inspector" was the title of the paper read by Mr. H. G. Clinch, Chief Inspector, West Ham. He pointed out that London had 3,200 boiler chimney stacks, 190 chimneys connected with metallurgical works, potteries, etc., and 5,800 other factory chimneys. There were 1,320 more boiler chimneys alone than in the whole of the West Riding of Yorkshire, "where things are made."

Mr. Clinch said that so far as the really big firms and combinations were concerned the problem was solving itself. Recent years had seen a diversion of interest from the engine room to the boilerhouse, in an effort to reduce power costs, and this had resulted in a general clean-up of the chimneys. The electrical supply industry provided a splendid example. Smoke production and wasteful boiler working went hand in hand, and when we found dirty chimneys we found dear steam. We had, in fact, arrived at the paradoxical position that the smaller the plant the greater the smoke production. This was because the small single-boiler plant was usually neglected and inefficiently worked, often with most unsuitable appliances, if any, and consuming unsuitable fuel fired in an unsuitable manner.

"The hard-headed business man," said Mr. Clinch, "is frequently found to employ unskilled labour (at unskilled rates of pay), run his boiler plant at fifty per cent. efficiency or less, blindly paying for coal by the ton knowing nothing whatsoever about its heating value or its behaviour on the grate, allow his chimney to emit periodical bursts of death-dealing soot and grit, then slap his knees and say 'The country is going to the dogs through high costs of production.'"

It was an amazing fact that probably nobody in the factory consumed as much of the firm's money as the boilerman, was paid so little for doing it, and yet was probably the only one from whom a balance sheet of cost and efficiency was not required.

In Germany those who desired to erect steam boiler plants must first obtain the sanction of the police authorities who may impose conditions

as to fuel used, height of chimney, etc. They might order a change of fuel. The education of the stoker was deemed to be a very important weapon in the smoke prevention crusade. In the U.S.A. nearly all cities made determined efforts to abate the smoke produced in manufacturing processes, and the ordinances of some required that all new plants be equipped properly and old ones remodelled, and permits were now necessary for the installation of all boilers and furnaces. We in this country had no such powers and it was high time that we were provided with such useful machinery.

It was the duty of every local authority to enforce the smoke abatement clauses of the Public Health Acts. Many did so, but in a manner which caused irritation and annoyance to the manufacturer and the hostility of his employees. No lasting cure was achieved; smoke was thinned by expensive dilution with excess air in an effort to avoid prosecution. Mutual confidence was destroyed and Council and Inspector alike were cheated and obstructed. Don't do it! urged Mr. Clinch.

"I have often heard people say," he continued, "that it is a waste of time to discuss the smoke problem with an industrialist or his fireman, but my experience proves the contrary. Given a bad chimney, a boiler plant wasting a few pounds a week, with stokers whose working conditions can be improved by the introduction of modern methods, and within three months a competent inspector can produce an owner who will be found to survey his chimney top at intervals and experience a genuine feeling of satisfaction when he sees nothing but a thin haze issuing therefrom. It has always been my firm opinion that the local authority can only hope to abolish the black smoke of the boiler furnace by friendly co-operation with both owners and men, coupled with very firm and constantly repeated legal action if they are so foolish as to resist any other method."

Mr. Clinch referred to co-operation between authorities, and quoted the Ministry of Health Circular 759 of 1927, which said "It may be possible to arrange that any exceptionally qualified officer in the service of any of the constituent authorities (of a Regional Committee) may be at the disposal of

the other authorities for any problem of special difficulty."

Smokeless Zones for London

The final paper of the conference was read by the Secretary, Mr. Arnold Marsh. The idea of tackling the smoke problem by the complete prohibition of smoke in limited areas, he said, was receiving much support. Central areas were particularly suitable for a number of reasons. They consisted mainly of business premises, shops, etc., all of which could be made smokeless without difficulty, and were the most important district of any town. A town was judged, by its citizens and especially by visitors, by the standards revealed at the centre. This was particularly the case in London, which after the war could look forward to a large share of the nationally important tourist trade. Many central areas had to be rebuilt, and this applied in London to the City area in particular. The new buildings should be smokeless and should not be forced to suffer rapid degradation by blackening and erosion because of smoke-emitting neighbours. The day population of central areas was very high and health and efficiency would be promoted by clean conditions and maximum sunlight. Business would have reduced overheads for cleaning and maintenance under smokeless conditions.

A smokeless zone, Mr. Marsh pointed out, would continue to suffer to some extent from the effects of the pollution from surrounding districts but it would benefit at once by the absence of the larger particles that fall near their place of origin. The larger the area of the zone the greater would be the benefit, and substantial benefits would be achieved with zones of one square mile or more in area.

"The legislative means for establishing smokeless zones," the paper continued, "could be secured by provisions in an Act of Parliament, e.g., on Town Planning, which would give to local authorities the power to apply byelaws under which specified areas could be declared to be smokeless zones, and in which the emission of any smoke would be considered a statutory nuisance under the Public Health Acts, 1936."

For London it was suggested that the first zone might be the whole of the City and those parts of Westminster

and Holborn contiguous with the City and bounded by High Holborn, Oxford Street, Park Lane, Grosvenor Place, Victoria Street or Vauxhall Bridge Road, and the river.

This would be of adequate size and would include most of the heart of the metropolis. "It would include the principal buildings, streets, squares and other features, and, incidentally, the centre of the Government in and around Whitehall, the open coal-fire smoke of which has in the past been notorious." It would give a magnificent opportunity to the architects and town-planners, and would create interest not only in this country but throughout the world. We should not forget that the prestige of London stood very high to-day, and that it would be of great value to London in more ways than one to maintain that prestige through bold and imaginative improvements in the coming years.

Mr. Marsh considered some of the problems of working out such a scheme. Firstly, all new building in the area should be smokeless from the start. Existing smoke-producing premises would have to go over to the use of smokeless fuels or be replaced or modernised by more suitable equipment. In practice this would be neither difficult nor expensive as far as commercial premises were concerned. The few industrial installations in the area could be considered individually, and in the case of undue difficulties could either be assisted or would be able to plead the "best practicable means" clause of the Public Health Act.

All new dwellings in the area were likely to be flats, where the greater part of the heating could be supplied from a central installation. Open fires should be of a type suitable for smokeless fuels. In existing dwellings there might be temporary exemption, but preferably there should be encouragement of the use of smokeless methods and the conversion of existing appliances by, or through grants from the local authority—as in sanitary modernisations.

It was pointed out that the initial zone was not the final objective. There could be other zones around the centre, and in time, by their progressive expansion, the separate areas would be joined together so that in the end the whole of Greater London would become smokeless.

THE NEW SMOKELESS GRATES

ELSEWHERE in this issue we report representations to the Government for the installation in new houses of open fires that will be suitable for the use of all forms of solid fuel. Recent advances in design have led to the production of open grates which, in addition to burning any type of smokeless fuel with greater efficiency than any previous type of grate, will, where necessary, permit the use of bituminous coal.

The first of the new grates we hope to be able to review and illustrate is the Fulham Grate, which is the result of extensive experimental work by the Gas Light and Coke Company. It is a development of the coke grate that proved to be so popular, especially in London and the south, before the war, but its new features are of radical importance. The pre-war grate gave an admirable fire with coke, anthracite,

economical to burn more free-burning fuels. In the new grates this has been overcome by making the ash-pit virtually air-tight by means of a closely fitting front and damper. When the front is in position and the damper closed no air can enter under the fire, and thus a minimum rate of combustion can be maintained. The turning of the lever in the centre of the front allows the damper plate gradually to fall back, as shown in Figure 2, until the required draught is attained. The louvres have been so designed that when the damper is fully open the effect is the same as if the front was taken away. The remarkable precision control obtained is made possible by the essential surfaces being machine finished so as to give a virtually air-tight fitting of both the detachable part of the front and the damper.

Another important feature of the fire is a shaped firebrick lining which in

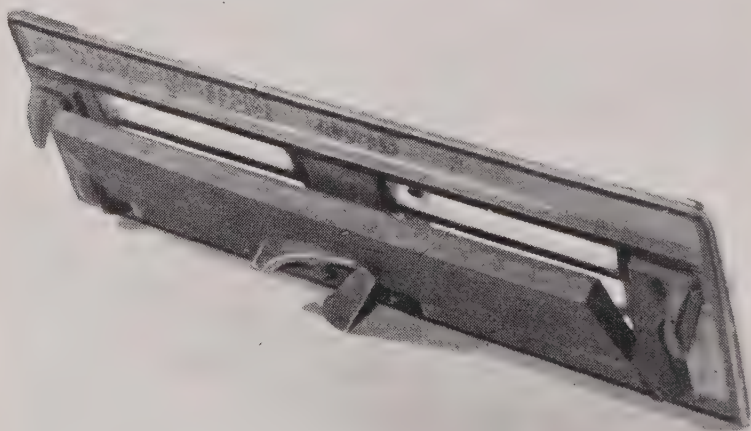


Fig. 2. Showing operation of damper.

or semi-anthracite, but it was not easy to control the draught of primary air (the air passing into the ash-pit and up through the firebars) so as to regulate the rate of combustion and make it

Figure 1 can be seen along the inside of the upper part of the front. This reduces the rate of conduction of heat from the base of the front part of the fire, so that the fuel is kept hot and its

ignition temperature more quickly reached on lighting and re-charging.

Using coke, this device actually increases the radiant efficiency of the fire from 29 to 34 per cent. Such an efficiency is excellent for an open fire in which simplicity of operation and low cost of installation are also important features. When, however, a higher capital cost can be met the fire can be used with convection heating, and by this means 60 per cent. of the heat of the fuel can be put into the room.

Ease and convenience of working are assisted by a removable ashpan, and by fittings which ensure that ash from the outer parts of the fire falls into the pan. The firebars rest upon a specially fitted frame and any space between the sides of the fire and the hearth should be sealed to prevent possible air leakage. Ignition is by a fixed gas burner incorporated in the grate. The front of the grate is of coloured vitreous enamel and the illustration indicates how pleasingly neat and simple it is.

Using coke or similar fuel the fire will need to be replenished every two or three hours if the weather is cold and maximum heat is required. When, however, a less intense fire is desired one charge of fuel will last for six hours or so. Space prevents us giving a full account of an actual test with gas coke, but readers who wish to have this and other technical details will find an article and a time-radiation graph in the June issue of *Coke and Smokeless Fuel Age*.

The writer has had the opportunity of using one of these fires in his own home under ordinary domestic conditions, and a few additional notes may be of interest. There is no doubt about the superiority of the grate over any pre-war type of fire in every respect.

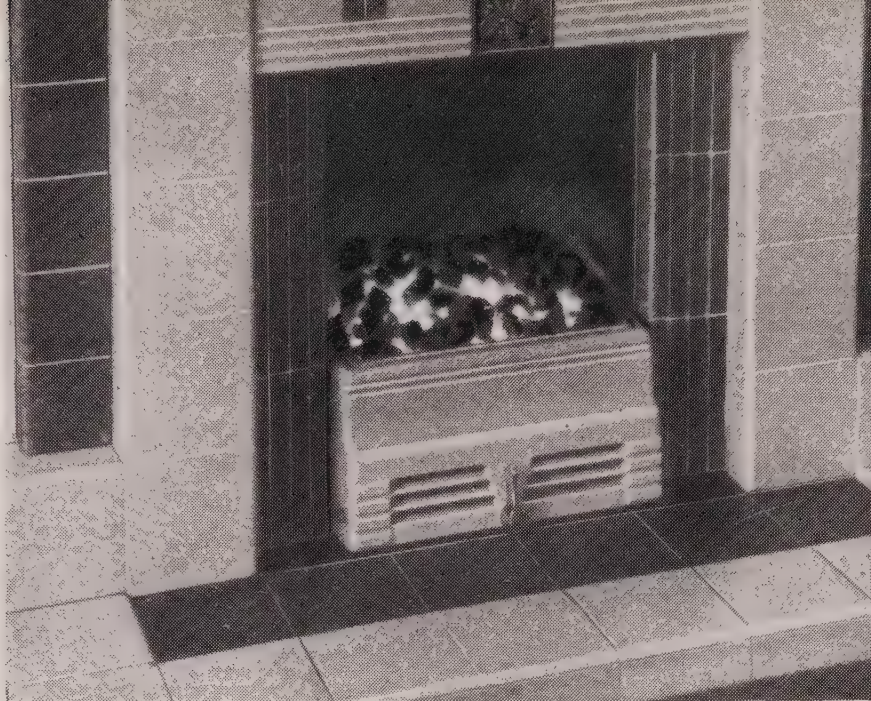


Fig. 1. The Fulham Fire.

The removal of ash is easy and there is a welcome absence of ash or fuel falling on to the hearth. Excellent fires, with respect to radiation, appearance, time of burning and control have been obtained with gas coke, smokeless Welsh coal, "Phurnacite" and "Coalite." The use of "Coalite" was especially interesting, as this fuel burns much more freely than the others and is comparable with coal in its combustibility. It requires little or no primary air for slow burning. On the Fulham fire, with the damper open, it produced an intense fire very quickly and then, with the damper closed, gave a slow fire that would, after over five hours, have readily burned up again if it had been recharged.

The highly effective control of draught, and thus of the rate of combustion, means that if it is necessary to use bituminous coal it will be possible to do so with better advantage than in the pre-war stool or other grates. It is likely, too, that the gas ignition and rapid power of "burning up" would considerably reduce smoke production when it is heaviest—during the stage of ignition. It is a pity, of course, that it should be necessary to consider the use of coal on a fire worthy of the more refined fuels, and it must be regarded only as a temporary expedient to be followed by measures to promote the general use of smokeless fuels.

Is it a Waste of Coal to Make Smokeless Fuels ?

AN address by Mr. J. G. Bennett, Director of the British Coal Utilisation Research Association, on "Has Coal a Future for Small Scale Uses?" was briefly commented upon in our last issue. An enlightening amount of discussion and criticism in the technical press has been provoked by Mr. Bennett's arguments and conclusions and readers will perhaps be interested to know the pros and cons of a debate that closely concerns the smoke prevention movement.

Mr. Bennett takes the efficiency of the normal present day coal fire as 24 per cent. (a test figure) and allowing for loss of effectiveness in ordinary use and applying an "availability" factor, reduces the effective net efficiency to 16 per cent. By availability factor the author means the unnecessary loss of heat that results from the fact that the fire cannot be turned off at will. Improved coal fires, he continues, will give a gross efficiency of 30-35 per cent. and a net efficiency of over 20 per cent. Experimental coal fires, which can be closed down when the room is not occupied have a net efficiency of 36 per cent. By taking warmed air from convection flues into upper rooms another 10 per cent. of the heat can be utilised, "so that we may ultimately hope to see raw coal burned with a net efficiency, after making all deductions for availability, of some 45 per cent."

Mr. Bennett then considers gas, and estimates that its efficiency of production, in terms of heat available in the gas, compared with the coal from which it is made, is 40 per cent. Later, in view of criticisms, this figure was amended to 46 per cent., and it is suggested that 50 to 60 per cent. is the ultimate target attainable. It is thought that the efficiency of the gas fire cannot be raised above 65 per cent., so that taking "availability" into account, gas heating has an ultimate figure of 33 per cent. compared with the coal fire's ultimate target of 45 per cent. Its present net efficiency is said to be

only 16 per cent.—the same as that of the present coal fire. These figures, it should be mentioned, do not seem to have found much agreement in the gas industry.

Electricity comes next. It is said that the average efficiency of electric generation from all power stations in this country is 22 per cent. with a final efficiency reaching the consumer of 18 per cent. Allowing a 5 per cent. loss for "availability," Mr. Bennett concludes that the net efficiency of the electric heater is also 16 per cent. For the future he does not think it likely that the elimination of the older power stations by new ones will do more than bring this figure up to 24 per cent. It is considered that district heating (which could utilise waste heat from power stations) has only limited application and could not alter the broad picture.

So, continued Mr. Bennett, there was little to choose under present conditions between coal, gas and electricity, and coal was the only medium where really big advances could be made. Points about coal conservation, storage, distribution and economics are discussed and still further weight the balance in favour of coal. Nevertheless, the author does not conclude that the use of gas and electricity will decline because of their important advantages of convenience in use.

About the loss of valuable and important chemicals that accompanies the use of raw coal, Mr. Bennett thinks there is a lot of loose thinking. "When coal is carbonised," he said, "about ten gallons of tar are obtained or about 4 per cent. of the coal substance. By no means all of this 4 per cent. consists of valuable chemicals. On the contrary, three-quarters goes in the form of road tar and pitch, the latter being in times of peace a drag on the market. The valuable chemicals—apart from benzole—derived from coal by carbonisation represent less than one per cent. of the coal treated. Now there are

other and better ways of getting valuable chemicals from coal and it seems to me that it would be more intelligent to burn 95 tons of coal in the raw state and convert 5 tons into chemicals than to carbonise 100 tons and lose 46 per cent.—or at best 20 per cent.—to make only one ton of chemicals. Chemicals from carbonisation are usually justified *because* they are by-products. You cannot turn it the other way round and say the chemicals justify the carbonisation.”

On this point we wonder if there is any need to turn it either one way or the other. The production of chemicals and of smokeless fuels are essentially complementary parts of one process. But we would refer readers to the paper by Mr. Harold Moore of which a brief account was given in our last issue.

And then on smoke abatement. Mr. Bennett said: “Here again I see no reason why the coal fire of the future should not be made to emit very much less smoke than it does to-day just as we have already achieved the smokeless large scale combustion of coal in power stations and factories. I entirely agree that smoke abatement is an urgent national problem but the natural way to solve this problem is to burn coal without making smoke and not to waste a lot of coal in making smokeless fuels.”

We Disagree

The statistics on which Mr. Bennett has based his many percentages have been sharply criticised from different points of view, and it would mean a lengthy and very technical article to deal adequately with the questions involved. But from our particular point of view the paper can be examined in a broader way.

If coal could be burned smokelessly in the domestic fire we might decide that the problem of whether it ought to be so used or not was no concern of ours. But so far there is no indication that it will ever be possible to burn it smokelessly in an inexpensive and simply-operated domestic appliance. Even Mr. Bennett suggests that in the future such fires may only “emit very much less smoke” than at present. That, we contend, is not enough. For smoke *abolition* we must either abolish the open fire or use in it smokeless fuels

only. At present it is not practical politics to advocate the abolition of the open fire, and the use of smokeless fuels is the only solution.

The increased use of smokeless fuels that we desire must depend upon increased carbonisation—low temperature, coke oven and gasworks—and must therefore result in an increased amount of gas. It is curious that Mr. Bennett should examine gas in isolation from coke, and does not consider the balanced use of these two complementary fuels. The figures he arrives at for the coal fire, whatever they are, must every time be bettered by the substitution of coke for coal under the same conditions, because of the greater efficiency of coke. The same argument applies also to the use of the important class of natural smokeless coals, which are also more efficient than bituminous coal and which should also be used to a much greater extent in the new types of “all fuel” fire.

In many homes of the smaller type a really adequate fuel service can be obtained from the use of 300 therms of gas and 40 cwt. of coke a year. For this 4 tons of coal will have to be carbonised. If the house were heated, and the hot water and cooking also provided, by the combustion of raw coal in existing types of appliance, at least $7\frac{1}{2}$ tons of coal would be needed to do the work.

As far as electricity is concerned there is admittedly a low efficiency in generation, which is partly offset by the very high efficiency of consumption. But as Mr. Bennett agrees, convenience is an important factor. If he could have assigned a figure for this, as he did for “availability,” then electricity, and gas too, would gain a marked advantage. If to convenience is added the factor of cleanliness, the advantage would be still greater.

It may be argued that convenience and cleanliness do not enter into a consideration of heating efficiencies. But is the real issue as restricted as that? Coal is used for the services, mainly as energy, that we can obtain from it. Practical coal conservation surely consists in obtaining maximum service from minimum consumption. Convenience and cleanliness—and above all the prevention of smoke—are services which people desire and for which it is sensible to use some of the

energy of coal. These factors must be included in any true comparison of the value of the different methods of heating.

Even from the narrower point of view of energy utilisation they must be taken into account. To take one simple example that could be extended almost indefinitely—if Mr. Bennett keeps to his coal fires and therefore had to use twice as much electrical energy for his vacuum cleaner in keeping his home as clean as it would be if he had used gas or electric heating, must not the extra energy so used be deducted from the efficiency of his coal fire? Somewhere or other energy derived from coal is used in most of the additional labour and other expenses caused

by the smoke nuisance. That energy is lost in unnecessary, unproductive uses, and is therefore wasted. And again, even if electric heating should use more coal than a hypothetical coal fire would it not be to the national advantage deliberately to use that coal thus on the grounds of improved health and amenities?

In terms of heat alone a balanced use of smokeless methods will compare favourably with coal; in terms of heat, chemicals, other services and smoke prevention, smokeless methods have an unquestionable supremacy. Raw coal is like a raw recruit: needing to be trained and disciplined before being able to give the best service.

CLEAN AIR AND PRACTICAL POLITICS

A Paper by A. C. Saword

A MOST constructive paper was read at a recent meeting of the Royal Sanitary Institute at Bolton by Mr. A. C. Saword, Chief Sanitary Inspector, Bolton. The author reviewed the smoke problem as it is to-day and considered that many of the suggestions that had been made for its abatement had not been acted upon by the Government because they were not practical politics, or, in some cases, because they could not be made into practical laws.

He suggested we should begin systematically to build a ladder which would get us over further disappointments, and outlined a series of rungs in this ladder. Firstly, there should be a publicity campaign on a national scale for the purpose of preparing the public to welcome changes in the law. Secondly, suggested Mr. Saword, all local authorities should take records of atmospheric pollution in their areas. This should be done by direction of the Ministry of Health, and the records should be carefully reviewed by the Ministry, so that "if any district failed to show an improvement year by year, or if any figures appeared excessive when compared with other towns of similar size and type, the Ministry

should investigate the cause."

Thirdly, all stokers should be licensed, following a suitable course of instruction.

Next, there should be legal control over the equipment of boilers and control over the type of fuel used for different purposes. "Coal should be graded as suitable for certain specified purposes and it should be an offence for a coal merchant to sell, or a person to use, coal otherwise than as specified."

Mr. Saword went on to consider control over the installation of new plant, and examined the proposals of the National Smoke Abatement Society for the prior approval of all new plant by a competent authority. This proposal was criticised on the grounds that "if local councils are to act as competent authorities we might find fifty or more local authorities in different parts of the country simultaneously asking questions and making calculations concerning the same type of plant. On the other hand, if the competent authority is to be a central authority it could hardly continue to keep all the plant under observation after it had been installed, and changes might subsequently be made in the specification or conditions of working."

Mr. Saword suggests that it would be simpler to require all types of fuel-burning plant to be tested and registered by the Department of Scientific and Industrial Research. The registration would set out the conditions under which approval was given, e.g., type of fuel to be used, maximum rate of firing, etc. If any smoke nuisance occurred from such a plant and the local authority's inspector found that the registration conditions had been evaded, that would be sufficient to prove an offence, whatever the colour of the smoke, and the defendant would be unable to plead that he had used the best practicable means for preventing smoke.

Domestic appliances for the use of solid fuel should also be registered.

The special industries which enjoy a certain exemption from the smoke abatement legislation would be included in the control of new installations, and this would ensure a gradual improvement as existing furnaces and boilers wear out and need replacement. In any cases where the prevention of smoke emission is not yet possible any new installation should require the approval of the Town Planning Authority of the district. It would then be up to this authority to restrict installations to exposed sites, away from built-up areas. The Health Committee should be consulted in such cases.

"I have suggested," continued Mr. Saword in discussion administration, "that the Department of Scientific and Industrial Research should be responsible for registering all types of fuel burning plant because that would be bound up with the subject of industrial research. But it should be clearly laid down that smokeless combustion must be one of the Department's prime considerations. I would not advocate the Ministry of Fuel for any duties in connection with smoke abatement because nobody can serve two opposing objects. The Ministry of Fuel is responsible for the production and distribution of fuel, and might find ideals of smoke abatement rather inconvenient when endeavouring to dispose of the worst grades of coal."

Some Comment

This short summary of Mr. Saword's paper will suffice to indicate the practicability of his proposals. We are especially interested in his consideration

of the Society's "prior approval" proposals because it is the first time that a reasonable alternative has been put forward. The registration of different appliances, with a stipulation of the conditions under which they may be used, is certainly attractive, and if a scheme could be operated so that the conditions of use were sufficiently comprehensive, it might well be that this would be preferable to the individual approval of each installation.

But a boiler plant is a complex affair and it seems an open question whether registration conditions could cover all the many factors that together make for maximum efficiency and minimum smokelessness in use.

Possibly a good solution would be an amalgamation of the two methods—registration of plant with conditions of use, followed by the approval of a local competent authority to ensure that the accessory factors—e.g., chimney construction, indicators and recorders, purpose and type of load of the plant, conditions of labour for the stoker or attendant, etc.—are suitable. The registration of the main items of equipment would certainly assist the local control, but is not some local control as essential as, for example, it is in building?

It is an important point, and Mr. Saword should be congratulated on having raised it in this way. As the time is approaching for making representations to the Government for ending the unrestricted installation of new fuel-burning plant it would be most useful to have the views of our technically-minded readers. Letters are invited.

An Important Conference

Arrangements are being made for an important conference on smoke abatement to be held jointly by the Institute of Fuel and the Society. Provided that conditions are then suitable—and we are optimistic enough to believe they will be—the conference will be held on Friday, October 27th, at the Institution of Electrical Engineers, London. There will be morning and afternoon sessions and in all probability the Society's own Annual General Meeting will be held the previous day. Details will be sent to all members and representatives in due course.

SMOKE SEEN THROUGH THE EYES OF A CHEMIST

Extracts from a Paper by Dr. E. Berl, Carnegie Institute of Technology, Pittsburgh, to the Smoke Prevention Association Convention, 1943.

SMOKE, fog and clouds are, so to speak, brothers, and from a scientific standpoint they are very much alike. In the case of smoke, solid, and in case of fog and clouds, liquid, highly dispersed particles exist as so-called interrupted phases. The uninterrupted phase is a gas, in most cases air.

In most cases smoke, or the cross breed between smoke and fog, our Pittsburgh smog, is an unwelcome phenomenon which we now observe less often here, thanks to the activity of our Bureau of Smoke Prevention under the very able leadership of Prof. Ely. Those of us who have seen the famous London fog know that here in Pittsburgh we are only amateurs. The London fog is due to the condensation of highly dispersed liquid water particles mostly on extremely fine smoke particles or on fly ash which is produced by burning the relatively young British coal, young in a geological sense. Dense London fog may contain more than 800,000 particles in one cubic inch. The English custom of using open chimneys adds very much to the formation of the unpleasant London fog. But we have smoke also in New York where, according to state laws, only anthracite coal or gas may be burned. Here the condensation of extremely small water droplets takes place mostly on dust which is formed, especially in great cities. By the way, the formation of dust from rubber tyres may contribute to this fog to a certain extent.

In order to get some insight in the phenomena which interests us, we should know something about the formation of carbon-containing smoke. The relatively best, but nevertheless imperfect, insight can be obtained by considering the combustion of natural gas—methane. If there is enough oxygen for such a combustion then methane as we know from our kitchen stoves burns without the formation of smoke to carbon dioxide and water. It would be a great mistake to believe that the chemical reaction

can be expressed simply by the equation :



The left side of the equation shows the situation when the curtain rises before the drama begins, and the right side shows the situation when the curtain falls after the drama has ended. This combustion reaction is really much more complicated than expressed by a simple chemical equation. The first reaction which methane undergoes if ignited in presence of oxygen is the formation of free hydrogen atoms which possess more energy than hydrogen molecules. These hydrogen atoms react with oxygen molecules and form HO_2 radicals, peroxide radicals. Simultaneously with the splitting off of hydrogen organic radicals the methyl CH_3 radical, the methylene CH_2 radical and the methane CH radical, furthermore the dicarbon radical C_2 , are formed. By chain reactions the methane molecule is finally degraded down to carbon monoxide and hydrogen, so-called water gas which we consider as gases ripe for combustion. With the exception of acetylene, carbon monoxide and hydrogen show in mixture with air the largest limits of explosion or combustion.

Very complicated reactions take place if methane is burned with insufficient amounts of air. Then smoke in form of colloidal carbon is formed, which is used to a very large extent industrially as carbon black, lamp black, as furnace carbon, as thermal decomposition carbon and as acetylene black.

Coming back again to the simple methane decomposition. We see that those free radicals which have been mentioned previously are the parent materials for these different smokes. The methyl radical (CH_3) is of little importance. It forms the methyl group which stops further polymerization of other radicals. The methylene radical (CH_2) can give rise to polymerization of chains and rings with or without a certain amount of bound oxygen. The hydrogen content in

these products is too high for the formation of smoke. The methane radical (CH) lends itself better to the formation of smoke than the methyl and the methylene radicals. Again oxygen-free or oxygen containing highly polymer polymerization products of this methane radical are obtained, and the same is true for the polymerization of dicarbon radicals (C_2). A polymerization of the radicals in ring form also takes place. At the end of this series, graphite is formed.

Unlimited Forms of Smoke

Unlimited numbers of different carbon smokes can be formed and in all probability no two smoke particles are completely identical. If one starts from more complicated systems than methane, like naphthalene or phenols, then an unbelievable multitude of different smokes are formed. Analogous to the smoke formation from methane, the form of the flames, their temperature, time of reaction, oxygen concentration, speed of cooling and other factors play fundamental roles concerning quantities and qualities of the resulting solid carbon compounds.

The electron microscope has given very welcome insight in the particle sizes and the frequency distribution of particle diameters of different carbon blacks.

As already mentioned, if we use more complicated parent materials instead of methane, the resulting smoke becomes more and more complicated. Organic material of any kind burned with insufficient amounts of oxygen forms, besides linear polymerization of the radicals, branched polymerization and cyclo polymerization, the latter under formation of rings of all kinds of non-branched or branched side chains.

Most of the smoke which is developed in larger, industrialised cities where there is a highly developed but not electrified railroad system comes from the imperfect combustion of coal. Besides the formation of smoke, that of carbon monoxide occurs. Only 29 per cent. of the heat of total combustion result if, instead of carbon dioxide, carbon monoxide is formed. We do not yet know exactly if carbon monoxide or carbon dioxide or both are the primary products of carbon

combustion. The speaker, based on experiments concerning the combustion of dicyan, believes in the primary formation of carbon monoxide. Smoke may be formed also by a secondary reaction according to: $2\text{CO} = \text{C} + \text{CO}_2$. Carbon before it reacts with oxygen has to be depolymerized into single carbon atoms.

Bituminous coal is the trouble maker in regard to smoke development, especially the bituminous coal with a lower carbon ratio. Coal in itself is a very complicated system. According to viewpoints which were developed by the speaker, it seems certain that the carbohydrate content of plants was the main parent material for bituminous coals. Lignites and fusains, the latter contained in comparatively small amounts in bituminous coals, show vessel structure and always form sandy coke and always contain methoxyl groups. Both are formed from lignin of which the parent material for bituminous coals, which was buried many million years ago, contained rather little.

The author showed that bituminous coals behave in many respects like artificial resins of the bakelite type. Bakelite is built up by the condensation of phenols with formaldehyde. Formaldehyde and other aldehydes may also have been formed from carbohydrates under geochemical conditions, and with the phenols they can form bakelite-like material—the bituminous coal. If coal is burned in poorly designed units then, besides the production of large amounts of carbon dioxide, a distillation occurs during which phenols and similar substances are formed. These retard many reactions and have a very high ignition temperature compared with substances rich in hydrogen which burn with little smoke.

The behaviour of bituminous coal is connected with its chemical composition. On the one hand, the partly aromatic composition of such coal is favourable if we convert a large part of the solid fuel into liquid fuel by hydrogenation. But in those installations where we use the coal as producer of heat energy, this formation of aromatic hydrocarbons and their oxidation products, phenols, is a very unpleasant property of bituminous coals.

SMOKE PREVENTION ABSTRACTS

A selection of Abstracts of recent papers and publications of interest. Acknowledgments are made for those taken from indicated Abstract sources.

9. Dust Extraction and Air Filtration Plant: Design and Control (W. J. Ellison, Text. Wkly, 1944, 33, 244, 285). A report of a lecture on the principles, advantages and disadvantages, and common errors in working, of air cleaning by (1) the use of dust settling chambers, (2) centrifugal or cyclone action, (3) impingement, (4) filtration, (5) electrostatic precipitation, and (6) wetting.

10. Removing Dust or Other Foreign Particles from Gas or Air (Westinghouse Electric International Co. B.P. 556, 939. Brit. chem. Abstr. B, I, 1944, 41). The dust laden air is passed in succession through a dry ionising zone and through water sprays which are electrified to opposite polarity by induction from loop electrodes of the same polarity as the ionising electrode wire, so that the dust and water particles attract each other and are collected together in entrainment eliminators.

11. Pneumonokoniosis of Coal Workers—a Method of Measuring the Health Hazard from Air-borne Dust. Interim Report (Mon. & S. Wales Coal Owners' Assoc. 11th Rep. of the Coal Dust Research Cttee, Nov. 1943). The method is based on a rough generalisation shown to exist between the specific surface of air-borne coal dust and the percentage by weight of dust less than 5 microns in size. The size factor of the dust is further allowed for by measuring the absorption of light in a suspension of the dust in alcohol after all particles larger than 5 microns have settled out. The method is straightforward and by the use of a series of tables, need not entail any elaborate mathematical calculations. The complete determination must be carried out in about 1 hour, and if suitable apparatus is used, two determinations can be carried out in about 70 minutes. The method gives the following information about the dust conditions at the point of sampling: (1) the mass concentration of the air-borne dust; (2) the specific surface of the dust, and (3) the mass concentration

of the dust of dangerous size, i.e. below 5 microns.

12. The Royal Observatory (Nature, 1944, 153, 175). As a result of the steady deterioration of observing conditions at Greenwich due to atmospheric pollution, the Admiralty has decided, in principle, that the Royal Observatory shall be moved to a new site where conditions are more favourable.

13. Survey of Progress in Electricity Generation (1919-1942) (by Vacuum, Steam Eng. 1943, 13, March, 180-85 and April, 208-13). Performance data relating to electricity generation in Great Britain and the United States are presented in the form of tables and graphs and a comparison is made of the progress in the two countries. Finally, the progress in the generation of electricity in the principle countries of the world is summarised.

14. Production of Free-burning Coke in Gas Works at Normal Carbonising Temperatures (G. M. Gill, Inst. Gas Eng. Communication No. 264). Describes experiments in the blending of coking or gas coal and non-coking coals produced in the locality of the gas works concerned. Tests on the ordinary fire, showing high radiation and economy, are given and illustrated, with comparisons of other fuels.

15. Underfeed Stokers (J. Inst. Fuel, 1944, 17, 133). A Summary by A. Coe, of a symposium on Underfeed Stokers as applied to Furnaces, arranged by the Institution of Fuel and the British Coal Utilisation Research Association.

16. The Fly-Ash Problem with Domestic Stokers and the Use of Settling Chambers and Firebox Baffles. (T. S. Spicer, R. G. Bowman and C. C. Wright, Tech. Publ. Amer. Inst. Min. Engrs., No. 1630, 1943. B.C.U.R.A. Bull., 1944, 8, 60). Tests with a baffled settling chamber installed in the flue showed that fly-ash difficulties arising with domestic underfeed stokers can be overcome when redesign of the furnace is not practicable.



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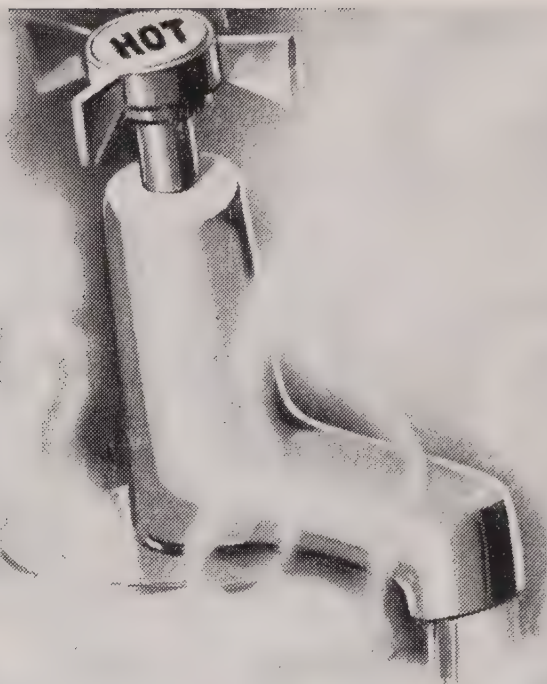
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SMOKELESS AIR

Housing Manual

We believe all our readers will agree that the Government's new Housing Manual, which is reviewed at length on another page, is a notable step forward in smoke abatement. In an official document of this kind it is most encouraging to find the smoke problem discussed in such firm phrases as "the Government attach particular importance, to smoke abatement" and "a wide-spread demand that the evil of atmospheric pollution shall be resolutely attacked." This welcome acceptance of the need for smoke abatement is, we believe, due in no small measure to the quiet but persistent efforts of the Society during the past two years, and to its steady building up of the case for smokeless air in the years before the war. The Manual's recommendations do not go as far as

we shall, in due course, want to go, but in them we have secured our immediate tactical objectives. Now it becomes urgently necessary to see that the recommendations are noted, understood, and fully accepted by the local authorities.

The Appeal

The Housing Manual, to keep to a topical form of metaphor, gives us an invaluable base from which we can launch further and more extensive operations. It means not less but greater and more urgent work by the Society. That, of course, we are eager to do, but the fact remains that we are still limited—very limited indeed—in what we can do because of our paucity of income. The appeal for further funds, which has been discussed in recent numbers of this journal, has now started, and we are now more

anxious than before that everyone who can possibly do so should help. Some gratifying responses have already been made to the appeal, though in many cases these have taken the form of special donations which may not be repeated. The Society is of course grateful for such donations but the real need is for an assured income that will allow it to budget ahead for substantial activity over a period of years.

The Conference

It was not possible, after all, to arrange the joint conference of the Society and the Institute of Fuel during the autumn, but it has now been agreed that the meeting shall take place in London on February 23rd, 1945. The Annual General Meeting of the Society will probably take place the previous day. Full information and an invitation to attend will be sent to all members in due course. The papers have already been arranged, and a very interesting and profitable conference can be anticipated. At the morning session the problem itself will be discussed with a paper on the pollution of the atmosphere by Dr. Dobson, Chairman of the Atmospheric Pollution Research Committee, and its consequences to the national well-being will be discussed by Major S. F. Markham, M.P., who among other qualifications has made a close study of the relationship between climate and civilisation. The afternoon session will be devoted to the problems of smoke prevention with papers on small scale steam boilers, industrial furnaces, kiln and pottery smoke, grit and smoke from power stations, domestic smoke, and railway smoke. The authors are each experts in their own field and their names will be familiar to our more technical readers—S. N. Duguid, Dr. Sarjant, A. T. Green, John Bruce, A. Blackie and M. G. Bennett.

The Labour Party on Housing

A comment in our last issue expressed the hope that the other political parties would follow the lead of the Liberals in making smoke prevention a declared part of their policies. The Labour Party, we are glad to learn, has made a general statement in its pamphlet "Housing and Planning after the War," coupling it with a practical and

apposite point on putting to good use the roofs of city flats: "Much more use might be made of flat roofs as children's playgrounds, particularly if the use of coal for domestic fires, causing soot from the chimneys, could be rendered unnecessary. Provision must be made for the supply of hot water to kitchen and bathroom. Tenants should be given a free choice of cooking and heating by electricity, gas, or alternative forms of heating. There are advantages in each, though the all-electric house or flat has become very popular where electricity charges have rendered it economically possible. Incidentally, it is becoming of ever greater urgency to abate the smoke nuisance in our large towns, largely attributable to the burning of coal in domestic grates."

The R.I.B.A. on Housing

The Royal Institute of British Architects has published an attractive booklet on housing. It states that all houses, whether new or old, should have "adequate protection from damp, from heat and cold, from noise, and from atmospheric pollution." That, however, is the only reference to atmospheric pollution in the report. In the vast programme of new housing that is to be undertaken there can be no protection from atmospheric pollution unless the new houses themselves are smokeless. It would have been extremely helpful to the cause of clean air—which will so greatly benefit the architect and his works—if the R.I.B.A. Housing Group could have come out more strongly on the side of smoke prevention. A sub-committee of the Institute's Science Standing Committee in 1929 published a report on smoke abatement which stated that "The Royal Institute of British Architects might with advantage organise means to inform the public, and suggest remedies and support any action which would remedy the evil of the smoke nuisance." In new housing and reconstruction generally, we would like respectfully to suggest to the Institute, there is a unique opportunity for substantially remedying the evil.

Housing Exhibition

The Ministry of Works Housing Exhibition at Birmingham illustrates

the three types of house recommended in the Housing Manual, by means of specimen ground-floor rooms. In one living room there is installed one of the new "all fuel" fires recommended by the Society, and in another is an openable stove of neat design and attractive finish set back in the hearth. A combination range installed in one house does not appear to have any means for the precise control of draught that should to-day be one of the first essentials of any solid fuel burning appliance. We are sure that there are available models more efficient and more suitable for smokeless fuels (as well as coal) than the one exhibited. In another kitchen a small solid fuel cooker of the insulated slow-burning type looked as if it would be most efficient. There is no general exhibition of the different types of appliance that will be available and the exhibition is therefore in no way comprehensive. There is an urgent need for a general exhibition of modern domestic heating appliances that can be installed in post-war houses and used without smoke emission.

Northolt

It is not possible in a short note to do more than mention one point about the experimental houses erected by the Ministry of Works at Northolt. Despite the Housing Manual recommendations on open fires it is dismaying to find that the open fires installed in most of the houses are of the cheap pre-war type of stool grate. It may be said that the new types of fire are not yet available, but in that case it would have been preferable to have left the hearths empty. In houses equipped by the gas and electricity industries all the appliances are up-to-date, efficient, and smokeless—with the exception, alas, of one of the stool grates in the all-electric house.

Escaping the Smoke

A significant discussion by the Stoke-on-Trent Education Committee recently arose from an alleged smoke nuisance near a secondary school in the city. The Director of Education said he thought in future secondary schools would be built outside the smoke belt. Another speaker said in future they should set their schools where land was abundant and air clean, and also provide transport to take the children out of the city all day. We find it difficult to make any comment on this news item, and so perhaps can leave it to the reflection of our readers.

Civil Aviation

The importance of civil aviation after the war needs no emphasis. What does need emphasis, however, is the fact that the development, safety and comfort of flying in this country will continue to be impeded until we have materially reduced the haze of smoke that overhangs many of the most valuable airports, reducing visibility and adding to the hazards of fog. A newspaper account of the Prestick airport suggests that here at least efforts will be made to retain smokeless air. "The land around the port," it is said, "will be 'frozen' to ensure seemly development and a proper relation to Professor Abercrombie's plan for the Clyde Valley region. There will be no coal-burning industries besides the airport to threaten its clear atmosphere. The visitor should make a happy landing . . ." We are sure that war-time experiences of flying over this country must have proved again and again what a menace smoke is. The increase in flying speeds demands still better visibility and the problem must now be more acute than ever. As soon as the war is over we hope to obtain new evidence about this most recent item in the indictment of smoke.

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HOUSING MANUAL

1944

Recommendations for Smoke Prevention

FROM the smoke prevention point of view the new Housing Manual of the Ministries of Health and Works (H.M. Stationery Office, 2s.) is noteworthy for its general attitude towards the heating installation and for the most satisfactory statement of principle on smoke abatement that has yet been made on behalf of the Government. This is contained in paragraph 116, and reads :

“The Government and the industries concerned are alive to the need for developing domestic fuel appliances and installations designed to give greater efficiency and to reduce the emission of smoke. Recently, both together and separately, they have sponsored an increasing volume of research towards this end. There is now a wide-spread demand that the evil of atmospheric pollution shall be resolutely attacked, one of its principal causes being the inefficient combustion of raw bituminous coal in the home. The Government attach particular importance to smoke abatement in view of the injury to health and to general amenities caused by atmospheric pollution. The extra labour of the housewife is another evil result which must not be overlooked.”

Again, in the introduction, it is stated that : “As far as solid fuel-burning appliances are concerned, when an appliance consumes fuel more efficiently and more completely, there is less emission of smoke. Some of the solid fuel-burning heat appliances discussed in this Manual are of this high-efficiency type, and in the interest of smoke abatement as well as of efficiency it is of the greatest importance that appliances used in housing shall be selected from this range . . .”

On the heating installation in general the Manual says, in paragraph 115, “The heat services of a house include

arrangements for room heating, cooking, hot water, and clothes washing. These different services are so closely interrelated that it is usually necessary to consider them as parts of a single composite installation. Both the comfort and amenity of the dwelling and the weekly running cost in terms of money and housework depend on the installation being simple, efficient, and well fitted for its particular job. But the importance of good heat services goes far beyond the single family. The mining of coal is costly, both in labour and money, and it is clear that the efficient use of coal (and of gas, coke and electricity, derived from coal) will remain a national necessity in peace as well as in war.”

The Open Fire

The particular and most vital point, for which the Society has been pressing, is that open fires installed in new houses should be suitable for any type of smokeless fuel. It has had to be admitted that such fires must also be suitable for the use of raw coal, because it is not immediately practicable to urge regulations restricting the use of coal. The essential requirement for new houses, the pre-requisite for future smokelessness, it has been stressed, must be the inclusion of appliances that, even if they use coal at first, can be operated smokelessly. This matter is dealt with and admirably covered in paragraph 133 :

“Where open fires are to be fitted, they should, from the point of view of smoke prevention, either be of a type which burns smokeless fuels (and also bituminous coal), or of a type which burns bituminous coal smokelessly. Typical smokeless fuels are anthracite, South Wales ‘steam’ coal, gas coke, low-temperature coke and other cokes and patent fuels. Satisfactory types of fire already exist for burning smokeless fuels (and bituminous coal). In addition new designs

are being developed for open fires capable of burning bituminous coal with a reduced emission of smoke; and it is hoped that satisfactory fires of this kind will become available shortly after the war."

There is some ambiguity between the expression "a type which burns bituminous coal smokelessly" and "open fires capable of burning bituminous coal with a reduced emission of smoke." On purely smoke abatement grounds the smokeless coal fire might be accepted, although as yet it is a purely hypothetical proposition. The permanent use of coal in a fire capable only of reduced smoke emission cannot be accepted, although there is nothing to be complained of about the fire, *as a fire*, because it will also burn smokeless fuels—quite smokelessly, of course—as well as bituminous coal.

The limitations of the open fire are noted, and a firm recommendation is made for the installation of openable stoves (para. 134):

"The openable stove is a far more efficient appliance than the open fire. It is primarily a convection heater, but it can also emit a useful proportion of radiant heat. It will normally provide over twice as much heat in the room as was provided by the old-fashioned grate. In addition, it has the advantage that it can be kept burning continuously, so that the labour of lighting and tending is reduced. It can be closed up when the family are out, so that they can return to a warm room and the fire risk is greatly reduced. Most types of solid fuel are suitable; perhaps the best results are obtained with a mixture of coke and bituminous coal. If bituminous coal only is used, special care in operation is necessary to avoid sooting up."

On this, we should like more information on the reputed best results from a mixture of coke and bituminous coal. Surely bituminous coal—the sooting up of which is noted—should no more be used in stoves than in domestic boilers. If the popularity of the openable stove can be encouraged the heating efficiency and comfort of our homes will be materially increased, and it is useful that improved types of stove will be on the post-war market.

Flats

Central heating and district heating,

both of which assist smoke prevention, are referred to in a paragraph (86) on flats:

"In flats where tenants are likely to be out all day there are advantages in the use of electricity or gas for cooking, room heating, and water heating. Central heating and hot water installations for blocks of flats may provide continuous service for the tenants at a lower expenditure of fuel and labour than similar service could be provided by individual heating units in each flat. The present method, however, of including the cost of hot water with the rent allows of no flexibility for individual expenditure, and, unfortunately, the problem of controlling consumption is not yet easy to solve. Where conditions are favourable, as for instance in close proximity to power stations, it is desirable to consider the possibilities of district heating schemes which may utilise waste heat and are expected to show considerable savings in fuel."

Insulation

The important factor of heat insulation is mentioned in general terms as follows (100): "A temperate climate and abundant supplies of fuel are probably the reasons why so little attention has been paid in this country to efficient heating and thermal insulation. The efficient use of our fuel resources has become a national issue which affects, and will continue to affect, every house in the land. At the same time, increasing familiarity with efficient heating installations in places of work—and, since 1939, in hostels, canteens, and other war-time buildings—has produced a demand for higher heating standards in all buildings including houses. It is not enough simply to generate more heat in the house; care must be taken to prevent the heat being lost through the floors, walls and ceilings in cold weather."

Electric Points and Gas Pokers

The use of electric fires, and consequent prevention of smoke, was often hampered in pre-war homes by a lack of power points. It is now recommended that advantage should be taken of recent developments for providing an adequate number of points by the installation of a ring main or room circuits providing all-purpose (3 kw.) socket-outlets. A

(Continued on page 29)

Smoke and Rain

by J. R. Ashworth, D.Sc., F.R.Met.S.

THERE is a tradition that the Indians of North America set fire to the prairies to bring down rain. The tradition has more often been disputed than acknowledged but facts disclose that the Indians had been taught in the best of all schools—the school of experience.

Lancashire, where mills abound and where smoke from factories permeates the atmosphere, is an attractive region for experiments and observations on what smoke can do in large quantities, and how it can yield results which may be overlooked and treated as incredible by those who live in purer air. In one of these Lancashire towns—Rochdale—it was observed that certain meteorological duties, which had to be undertaken every day, were not as often interfered with by rain on Sundays as on other days, and this casual observation led to an examination of the rainfall records of the town. In the first place the rain on Sundays was abstracted for a period of ten years and compared with the rainfall on each of the week days. In this period the Sunday rainfall was less by 13 per cent. than the average of all days and less than any other day of the week. At Stonyhurst, where mills and smoke are at a distance and less in evidence, the rainfall, measured at the observatory there, was abstracted in the same way and for the same period, and the difference between Sundays and weekdays, as expected, was smaller than for Rochdale.

Rainfall is one of the most capricious of the meteorological elements and ten years was deemed not long enough to carry conviction and disarm criticism, and so the much longer period of 30 years at Rochdale was examined and abstracted. It led to the same result. Finally another 15 years have been added recently to the 30 years, and now the long period of 45 years is available and confirms the results of the other periods, and the conclusion is that weekdays are more rainy than Sundays. The difference in the amount of rain is small, about 6 per cent., but

in a total rainfall of 44 inches per annum the excess of weekdays over Sundays amounts on the average to about 2 inches in the total of a year. Here are the average annual totals for each day of the week :

<i>Sun.</i>	<i>Mon.</i>	<i>Tues.</i>	<i>Wed.</i>	<i>Thurs.</i>
6.01	6.44	6.30	6.45	6.40
<i>Fri.</i>	<i>Sat.</i>	<i>Average</i>	<i>Total</i>	
6.25	6.56	6.35	44.41	

To analyse the rainfall in more detail a continuously recording rain gauge was set up and the rainfall hour by hour was determined for Sundays and weekdays. When a graph is made for the 24 hours of the day the curve of weekday rainfall is always above the curve of Sunday rainfall during the hours between 7 a.m. and 6 p.m., just the working time of the factories but at night the two curves run closely together. This again shows that weekday rainfall during factory working hours, when smoke is freely emitted, is above what may be called the natural rainfall exhibited by Sunday. Once more a further step in the analysis shows that the rate at which rain falls agrees very well with the rate of atmospheric deposit which may be taken as a measure of smoke emission. Thus three different lines of investigation lead to the same conclusion.

Again, if smoke tends to produce rain we may expect that it will be accompanied by cloudiness and cloudiness implies loss of light. Observations not only in Rochdale, but in Huddersfield and other factory towns, of ultra-violet and daylight rays are in entire agreement with this deduction, for weekdays have distinctly less light than Sundays. In passing it may be remarked that light observations are a delicate test for smoke pollution, and it is interesting to find that seaside and other health resorts do not show that weekdays have less light than Sundays ; they have however their own characteristics which are interesting to trace.

But can we find any physical reason for the connection between smoke and

rain? The answer is not far to seek. It is now generally held that air saturated with moisture will not deposit its moisture as rain unless there are nuclei, that is, microscopic particles, in the air on which the moisture can condense, and if the particles have an affinity for water, in short, are hygroscopic, the deposition of water upon them will be facilitated.

Now smoke supplies what is required, namely, a vast quantity of fine particles of ash, thrown into the air, along with finely divided matter, of a highly hygroscopic nature; together they condense the moisture into minute vesicles of water and these unite to form rain-drops. Thus air, ready to deposit moisture, has its water vapour condensed and deposited by smoke particles when, in the absence of smoke, it would have passed on without producing rain. The clouds which form in a polluted atmosphere may drift along to a considerable distance from their source and the evil effects of smoke may be carried much beyond the area where it is produced.

It may be thought that smoke could not rise high enough to produce the effects which have been mentioned. But listen to Lord Sempill, a pioneer of aerial flight. He says:

"I noticed that the smoke over Manchester, Sheffield, Huddersfield, Leeds, etc. went up at least 6,000 feet and in some cases to 8,500 feet." And again: "Flying over the Welsh Hills west of Birmingham with N.E. wind the smoke from Birmingham caused visibility to drop *and there was slight rain*—the machine was absolutely filthy."

Housing Manual—*continued*

schedule of recommended outlets is given, in which the total number prescribed, excluding those for refrigerators, washing machines, or cookers, varies between 12 and 14 according to the type of house.

Reference is made to the convenience of the gas poker for lighting solid fuel, and, "where the service is available a gas point should accordingly be provided next to solid fuel fires, also in connection with stoves, cookers, and boilers. A gas lighter is incorporated in many modern smokeless fuel grates."

We hope the general practice will be for the installation of these gas-ignited grates. The Manual also recommends what the Society has for long advocated—the provision of ample storage space for two types of solid fuel.

The Manual is a general guide, and will be supplemented by a series of Technical Appendices, now in preparation, of which one will be on "Cooking and Heating," and another on "British Standards and British Standard Codes of Practice."

Since this article was written a further important report has been published. This is entitled "Solid Fuel Installations" (Post-War Building Studies No. 10, H.M. Stationery Office, 9d.). It is the report of a Committee convened by the B.C.U.R.A. at the invitation of the Ministry of Works, the terms of reference of which included recommendations for practice in post-war building having regard to reduced emission of smoke from dwellings. The Report will be reviewed at length in our next issue.

Other Local Authorities Please Note!

"On behalf of the bronchial and catarrhal subjects of this town and district, and on behalf of housewives and mothers, it can be said that the gesture of the Health Committee in doubling the town's annual subscription to the National Smoke Abatement Society will be greatly appreciated."

Oldham Chronicle, 21st October, 1944.

REVIEW

Must the New Houses Produce Smoke?

Design of Dwellings. Report of the Design of Dwellings Sub-Committee of the Central Housing Advisory Committee appointed by the Minister of Health. H.M. Stationery Office, 1s.

Heating, Cooking and Hot Water Supplies for the Post-War House. Summary of Views of the Women's Advisory Committee on Solid Fuel, 1s. 3d. post-free, from the Organising Secretary, 4 Rickett Street, London, S.W.6.

"Daily Mail" Book of Britain's Post-War Houses, 3s. 6d.

THESE three publications dealing with housing in the post-war period approach the problem of domestic smoke differently. The Government Report is disappointing, all the more so because it is on the whole a very good report. It is essentially a human document—it deals with human beings as well as bricks and mortar, and the reactions of families to their surroundings. The Dudley Committee has examined with sympathy and understanding the masses of evidence submitted to them, including criticisms by housewives of existing houses. The Report is very pleasantly written and being well within the scope of non-technical people is likely to be widely read. As a matter of fact women in H.M. Forces, who manifest a keen, personal interest in post-war housing, are preparing to use it in their discussion groups. All the more pity therefore that the feeling of the Committee is so tepid towards the crying need for clean air in towns. There is no sign in the Report that they had in mind the vast amount of atmospheric pollution the millions of new houses projected would produce unless something really drastic was done in the matter. It is true the Committee admits a strong case on the evidence submitted to them for better heating arrangements and cooking

facilities, and it is also true that when the Dudley Committee reported the Heating and Ventilation (Reconstruction) Committee of the Building Research Board had not finished their deliberations. Pending the report of the latter, the Dudley Committee would be justified in refraining from final pronouncements but not surely in omitting to urge that the problem of domestic smoke was a matter of very great urgency. A single sentence in para. 121 recording "a great need for more efficient labour-saving coal-burning grates and stoves which will give more complete combustion of fuel and reduce atmospheric pollution" is all there is directly to the point on this most important issue. It is not even hinted that the one open fireplace advocated for each house might be constructed to burn smokeless fuels. Fortunately the Housing Manual, 1944, issued later than the Dudley Committee's Report, by the Ministry of Health jointly with the Ministry of Works, has come out definitely on the side of smoke prevention (see p. 26 of this issue). Nevertheless it is regrettable that a document issuing from the central department concerned with the health of the nation, and designed to give a lead to local authorities—and also to private enterprise—should be backward in so vital a matter.

The Report of the Women's Advisory Committee on Solid Fuel takes a strong line with regard to domestic smoke and states emphatically that "clean air is necessary to the health of the nation" (para. 13). The Committee "attach the greatest possible importance to smoke abatement and the reduction of atmospheric pollution due to the wrong use of raw coal" (para. 9). They look forward to a time when smokeless fuel, produced by low or high temperature carbonisation, will become available in greater quantities. They think, however,

it will be many years before the possibility of abolishing the use of raw coal can be seriously considered,* and recommend attention being turned in the meantime to providing more efficient coal-using appliances capable of reducing smoke. The Advisory Committee gives full credit to the usefulness of gas and electricity and regards great developments in both services as probable in the future. In Appendix XII, which deals with The Importance of the Use of Raw Coal in Supplying Domestic Heat, they admit that "if convenience and cleanliness are taken into account the use of gas and electricity may be preferred" (page 30). The point in favour of coal that it can be stored is an important one as war-time emergencies have emphasised; but solid smokeless fuels can also be stored though it is true they take up more room. Very wisely the Report declares that "no short term measures of a haphazard nature should be permitted, even immediately after the war. We must begin as we mean to go on, and provide householders with the best possible heating services from the start." It is pointed out that good heating services may increase the cost of housing in the immediate post-war years, but the Committee see "no reason why the increased cost should be permanent, if research and technical developments are pressed forward with vigour" (para. 23). A further point made that a better equipped house will have lower running costs needs to be pressed home with future tenants and owner-occupiers, for most householders at present are paying very dearly in fuel bills for such heat as they get. The Committee does not assert that methods of burning bituminous coal without making smoke have yet been achieved. They refrain so far as the present report is concerned from putting forward any final plans, but intend to suggest from time to time methods whereby improvements in efficiency and cost of domestic heating services may be utilised to the best advantage by the women of the country." We shall look forward with interest to further reports from this Committee which aims at "providing a link between the house-

wife on the one hand, and research workers and technicians on the other."

The *Daily Mail* publication intended as a substitute for the popular Ideal Homes Exhibitions of pre-war days is attractively written and illustrated, and is based largely on replies to questionnaires broadcast to housewives throughout the country. Some interesting accounts, however, are given, with photographs and plans, of the post-war housing schemes of certain local authorities. This book gives due prominence to the smoke question. It was found that the open fire was "first favourite" for the living-room, and the compiler suggests it is possible that more fires, designed for smokeless fuels, which do not give off the flame and sparkle of bituminous coal, "may be the first step in weaning us from the open fire as we know it to-day. She believes most women would sacrifice something of the visual enjoyment derived from a raw coal fire for the sake of cleaner air. The experimental work of the Coal Utilisation Council with the new open fires designed to reduce smoke is described as well as a coke fire intended for 24-hour service, and statistics are given showing the overwhelming preference of housewives for gas and electricity to solid fuel for cooking purposes.

M.F.

Correspondence

The Editor,
"Smokeless Air."

Sir,

My attention has been drawn to the unfortunate slip in the letter from me on the subject of "Coal" which you were good enough to publish in the Summer issue of *Smokeless Air*.

In paragraph 5 I wrote that "As regards production of valuable chemicals, it is no longer true to suggest that the most economical way of obtaining these from oil is necessarily by carbonising it."

I need hardly say that the word "oil" should have been "coal" and I shall be grateful if you will publish this correction in your next issue.

Yours, etc.,

H. J. GILLESPIE.

Mining Association
 of Great Britain.

* See, however, *Smokeless Air*, Summer 1942, 49, 22, in which Dr. G. E. Foxwell showed that sufficient smokeless fuel to replace raw coal could be provided within three years if the Government and industry would plan ahead.—Ed.

A New Metro Fire

ANOTHER of the new types of open fire, suitable for all forms of solid fuel, which we are able to describe, is a new model of the Metro fire. This is a development of the popular pre-war model of the same name and is the product of work by the South Metropolitan Gas Company and Messrs. Sidney Flavel & Co., Ltd., of Leamington.

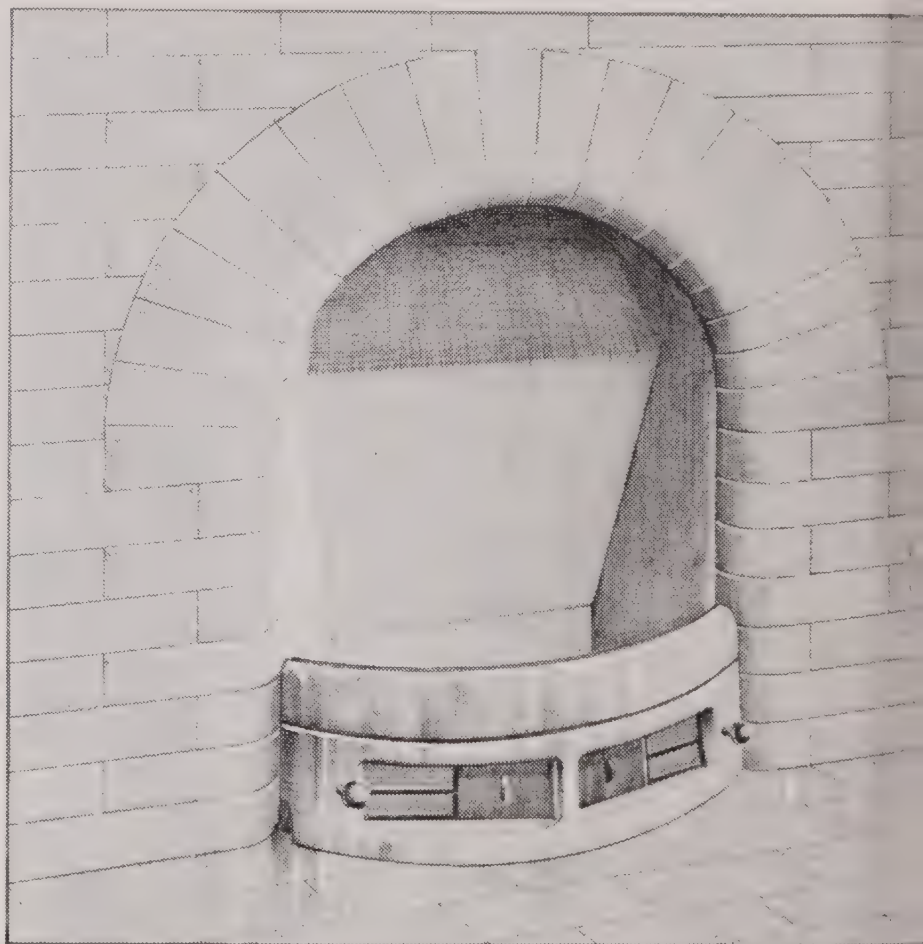
The principal feature to be noted is, as with the Fulham fire previously described, that there is a really efficient method for the control of air passing up through the fire. The intake of air is controlled by sliding dampers, which can be seen in the illustration. The damper surfaces are machine-finished to ensure close fitting, and when closed virtually no air can enter under the fire. Air is admitted simply by sliding the dampers, and their position is always clearly visible. When they are open air is admitted so that it is readily distributed over the whole surface of the grate. With this form of ventilator the fire can be lighted and the ash raked through the bars without removing the front plate.

The fire is, of course, fitted with concealed means for gas ignition. Deflectors collect the ash from the sides of the fire and spill it into the ash-pan. The firebars are of robust construction, and they, together with the frame on which they rest, can be adjusted to suit varying widths and depths of firebrick. For the present the fire is made in one size only, suitable for fireplace openings 16 inches wide.

Tests, using gas coke, show that the fire can be lighted

in 15 minutes, and is bright and cheerful within 45 minutes of lighting the gas. When fully banked, with the dampers closed, the fire will burn from 5 to 6 hours without attention, and will recover within 30 minutes of refuelling. The rate of combustion can be varied from $2\frac{1}{2}$ to 3 lbs. per hour to a minimum of less than 1-lb. per hour. Even on the coldest day, with the dampers fully open, the fire will burn without attention for 2 to 3 hours.

The efficiency of control make the fire suitable not only for the harder fuels, such as coke, anthracite and Welsh steam coal, but also for "Coalite" and other free-burning fuels, including, for the time being, bituminous coal. It thus meets the requirements of the recommendations for post-war housing made in the Government's new Housing Manual, which is discussed on another page.



Block by courtesy of "Coke and Smokeless Fuel A

THE CONTROL OF FUEL BURNING INSTALLATIONS IN THE U.S.A.

THE Society has recently been obtaining information from cities in the United States on smoke prevention ordinances and regulations for the approval, or licensing, of new fuel burning plant and alterations to existing plant. One of our own most important proposals for the prevention of smoke in post-war development in this country is that similar regulations should be introduced here. It is clearly the logical first step in smoke prevention, and the fact that there are such regulations in force in most of the cities of the United States, as well as in other countries, proves that there is nothing difficult or impracticable about them. They appear, too, to be willingly accepted by the users of plant, just as our own building regulations are accepted.

By contrast, our own present system is rather absurd. We allow any technically incompetent person or concern to install what often proves to be unsuitable plant, we allow it to be used wrongly, with perhaps a gross wastage of fuel—and only *after* the inevitable smoke nuisance is committed are we able to step in and seek improvement.

In the United States smoke prevention is the concern of the City, or local authority, and there is no national legislation as in this country. City ordinances therefore vary widely in their form and requirements and in the way they are administered. For general guidance and to secure more uniformity the Smoke Prevention Association of America has prepared a model ordinance, and we cannot do better than quote in full the section dealing with the approval of installations :

“No new plants nor reconstruction of any existing plants for producing power and heat, nor either of them nor any new chimney connected with fuel burning plants, shall be erected or maintained in the City until plans and specifications of the same have been filed in the office of and approved by the Smoke ——— [title of official] and a permit issued by him for such erection, reconstruction or maintenance. Plans

and specifications to be filled with the ——— [title of department] shall show the amount of work and the amount of heating to be done by such plant and all appurtenances thereto—including all provisions made for the purpose of securing complete combustion of the fuel to be used and for the purpose of preventing smoke ; said plans and specifications shall also contain a statement of the kind of fuel proposed to be used and said plans and specifications shall also show that the room or apartment in which such plant shall be located is provided with doors, windows, air-shafts, fans and other means of ventilation sufficient to prevent the temperature of such room, apartment, basement or other portions of such building, wherein such steam plant or apparatus is to be used, from rising to a point higher than one hundred and twenty degrees, Fahrenheit, and sufficient also to provide that the atmosphere of any such apartment, wherein such apparatus may be located, may be entirely changed every ten minutes. Upon the approval of such plans and specifications a duplicate set of which shall be left on file in said office; and upon the payment of the fees as hereinafter provided the Smoke ——— shall issue a permit for the reconstruction, erection or maintenance of such plant. The Smoke ——— shall see that the execution of the work permitted is carried out in conformity with the plans and specifications, with special reference to the amount of space used, the size and construction of the chimney or chimneys used, the provision for the prevention of smoke, and the provisions for ventilation, and for the proper temperature of the boiler room.

“It shall be unlawful for any person to use any new or reconstructed plant for the production and generation of heat and power, or either of them, until he shall have first procured a certificate from the Smoke ——— certifying that the plant is so constructed that it will do the work required, and that it can be so managed

that no dense smoke shall be emitted from the chimney connected with the furnace or fire box."

This is similar in purport, though with some differences, to a standard ordinance put forward by the U.S. Bureau of Mines in 1930. This contains a clause to the effect that "minor or emergency repairs which do not increase the capacity of such furnace, or which do not involve any substantial alteration in such furnace, boiler furnace, stack or other apparatus, and which do not involve any alteration in the method or efficiency of smoke prevention, may be made without a permit."

This ordinance provides that any application shall be approved or rejected within ten days, and in the event of rejection gives the applicant the right to appeal to an Advisory Board, which by a majority vote may either reverse or confirm the rejection.

It will be seen that the regulation concerns itself not only with the nature of the plant and the means to prevent smoke, but also with the kind of fuel to be used, and the ventilation of the boiler-room or other place in which the fuel is to be burned. The question of fuel is of course of considerable importance, and it seems appropriate to deal with ventilation here rather than elsewhere. It is a problem distinct from methods to be used for the ventilation of the rest of the building, which is presumably covered in the building regulations.

Many of the principal cities use one or other of these model ordinances, perhaps with some slight modifications. Out of 75 cities replying to a questionnaire from the Smoke Prevention Association all but 19 stated that new installations and alterations were supervised under Ordinance authority. In most cases, as far as we are aware, the section of the ordinance dealing with installations is similar to the two models referred to above, though with some there are working codes and detailed regulations in which are stipulated the technical requirements for different types of plant.

Take, for example, the case of Cincinnati, Ohio, a city about the size of Leeds. Normally the smoke abatement staff consists of a Chief Smoke Inspector, eight other inspectors, and assistant and junior engineers. The Bureau of Smoke Inspection is part of

the Division of Buildings of the Department of Safety, and the regulations are a part of the Building Code. Chapter 15 of the Code deals with "Heating, Smoke Abatement, Mechanical Ventilation and Refrigeration," and contains over 150 sections, running to nearly 20,000 words. The heating division covers in detail all the principal factors relating to the construction, equipment and control of fuel-burning installations, and although this at first sight may appear formidable there can be little doubt that the existence of such precise data must greatly assist all concerned and result in a steadily improving standard of fuel economy and smoke prevention throughout the city.

The material kindly sent us by the Cincinnati authorities reveals the efficient organisation of the work of smoke inspection and inspection of plant. There are five different forms of application for permit, covering stokers, gravity warm air heating plant, mechanical or forced warm air heating plant, heating and power boilers, and oil burners, gas burners, etc. Each application form requires the giving of the essential data about the proposed installation. On approval, within ten days of application, and upon receipt of the necessary fees, a permit is issued. The inspectors make periodic inspections of the installations until completed and approved. Any necessary certificates are issued. In connection with boiler installations the inspectors also ensure that the boiler safety laws of the State of Ohio are observed, and likewise any fire protection and safety laws of the National Board of Fire Underwriters and the State.

In St. Louis (see the ordinance in the N.S.A.S. memorandum on Smoke Prevention in Relation to Initial Post-War Reconstruction) and in Pittsburgh the ordinances include a clause restricting the use of high volatile coals. The Pittsburgh clause reads thus:

"It shall be unlawful to import, sell, offer for sale, expose for sale, exchange, deliver or transport for use and consumption in the City of Pittsburgh, or to use or consume in the City of Pittsburgh any solid fuel for hand-firing or surface-burning types of equipment which does not meet the standard of a smokeless solid fuel as set forth in this section.

"Smokeless solid fuel for the purpose

of the enforcement of the Ordinance shall be considered a fuel, the volatile content of which is 20 per cent. or less on a dry basis. Provided, however, that if a fuel contains volatile matter in excess of 20 per cent. on a dry basis, it shall be acceptable under the terms of this Ordinance provided that it meets the same standards in regard to smoke production as that of a fuel containing less than 20 per cent. volatile matter on a dry basis, and subject to the following conditions in order to ascertain whether such standards are met. . . ."

Then follows provisions for the testing and approval of fuels. The section ends with a clause declaring that "the provisions of this section shall go into effect six months after the cessation of the war in which the United States is now engaged, save as otherwise provided in this ordinance."

A further Pittsburgh clause exempts for the same period "buildings used exclusively for private residences containing less than three dwelling units or flats" and "buildings used exclusively for private residences that do not contain a central heating plant" from the provisions prohibiting the emission of dense smoke. It is intended, therefore, to include all dwellings when normal conditions return.

The Pittsburgh ordinance makes it obligatory for the seller of any fuel-burning equipment to report all sales for installations within the city. Inspectors are authorised to enter the premises of sellers of equipment and to examine books, papers and records pertaining to sales.

Baltimore has an unusual exemption

clause in its installations section. The submission of plans and approval by the Commissioner of Smoke Control, it is stated, "shall not cover or include the manufacturing processes of metallurgical, chemical, oil refining processes, ceramic, other commodity manufacturing industries, or any proprietary or secret process, but in such cases it shall be incumbent upon the applicant to produce evidence only that the proposed installation will be suited for the prevention of the emission of smoke to the degree prescribed in this ordinance."

American practice, it is clear, can teach us much in our efforts to obtain similar control in this country. Now that one of the Society's immediate objectives on domestic smoke has been gained it seems desirable to concentrate more closely on this problem. In view of that vast amount of fuel-burning plant that in the next few years will be installed in new buildings, required for industry, and needed to replace plant outworn by war-time demands, the sooner such regulations can be introduced the more valuable will be their effect.

The general principle is likely to be accepted by fuel technologists, users, and appliance makers, but it remains necessary to convince the Government and to work out a form of legislation that will be suitable for this country, together with the administration that will be required. The American methods may or may not be the most appropriate, but they do at least provide an excellent object lesson in what ought to be done and what, in actual practice, is being done.

West Riding Regional Committee

The Committee, which is one of the two Regional Committees to have maintained their activity during the war, has published its annual report for 1943-44. Six meetings were held and included a series of special lectures on smoke abatement in post-war planning and reconstruction. During the year the Committee undertook a complete revision of the constitution. One recommendation is to increase the number of representatives of the Urban

Districts on the Executive Committee from 8 to 12. Other matters dealt with included a complaint about smoke emission from school canteens in the West Riding where cooking apparatus using coal in its raw state had been installed, and a circular from the Ministry of Fuel and Power requesting local authorities to consult them prior to taking action under the Smoke Abatement byelaws. It was felt that this was encroaching upon the prerogatives of local authorities, and the circular was therefore referred to the Annual Meeting for general discussion.

RAPID SURVEYS OF ATMOSPHERIC POLLUTION

Contributed by the Department of Scientific
and Industrial Research

ATMOSPHERIC pollution, which may be regarded as the chief cause of the difference between the air in towns and the fresh air of the countryside, may, in general, be said to consist of—

- (i) relatively coarse solid matter, such as ash or grit which is usually deposited fairly quickly near to its place of origin ;
- (ii) fine solid matter, such as smoke, which remains suspended in the air for a relatively long time ;
- (iii) gases, such as sulphur dioxide, emitted from domestic or industrial chimneys, engines, etc.

It is relatively simple to record the quantities of each of these forms of pollution and, from the records over a period of time, to determine whether the pollution in a town is changing in its quality or quantity.

It is becoming increasingly important, however, to be able to make more rapid estimates of the distribution of pollution in a particular locality at any given time, since, although the normal type of recording apparatus is very simple, it cannot usually provide reliable information *quickly*.*

Where such information is wanted at short notice, e.g. as part of the consideration of post-war industrial or housing plans, it may be obtained with sufficient accuracy for the immediate purposes by the methods described below.

I. Deposited Solid Matter

The estimation of the rate of deposition of solid matter calls for only the

simplest of apparatus ; a number of shallow dishes, about 9 cms. ($3\frac{1}{2}$ inches) in diameter. These dishes (petri dishes) are provided with lids which are only removed during actual exposure in an experiment, or while the collected solid matter is being removed from the dishes before weighing.

The procedure is as follows: At least nine, and preferably more, sites for dishes are chosen at $\frac{1}{4}$ mile intervals all over the area to be investigated, care being taken to select sites, preferably about 10 feet above ground, where interference by the public or by animals can be prevented. When there appears to be reasonable prospect of enjoying 48 hours of dry, calm weather the dishes should be distributed and their lids removed. After 48 hours, the dishes should be collected (the lids being replaced). If the dishes are collected in the same order as that in which they were distributed, the period of exposure will be approximately the same for each one. The contents of each dish should be brushed on to a watch glass with a dry brush and weighed in the watch glass to an accuracy of $1/10$ milligram. The same watch glass should be used for all weighings.

It should be emphasised that the weather conditions during the experiment should be carefully watched, for if rain or strong wind occurs, the experiment will be a failure. What is required is a period of settled, anticyclonic weather. The direction of wind may be important, as it is often desirable to make observations in the prevailing wind or in a wind which blows pollution from a particular area.

At intervals during the experiment, observations should be made of the wind and any changes in weather ; also of any special sources of pollution. If rain threatens or a wind begins to spring up, the dishes should be covered and taken indoors ; usually it will be wise to clean them and begin the experiment

*It is important to recognise the limitations of rapid surveys. Thus even on meteorologically similar days there may be meteorological differences which will cause differences in the general level of pollution. Hence, while a rapid survey may be trusted to give a reasonably true picture of the distribution of pollution, it would not be safe to use the results of two rapid surveys separated by, say, a few years, to determine whether the general level of pollution was changing over that period. Such a determination could only be made by examining continuous records over the whole period.

again when the weather clears. No special apparatus is necessary to determine wind direction, which should preferably be observed by noting the direction of the smoke issuing from a tall chimney; weather cocks, flags, and even clouds are not always reliable indicators. The wind velocity can be estimated roughly on the Beaufort scale as follows:—

	Force (Arbitrary Units)	Velocity (m.p.h.)
Calm; smoke rises vertically	0	0
Direction shown by smoke-drift only, no pronounced sensation of air movement	1	2
Wind felt on face; leaves rustle ...	2	5
Leaves and small twigs in constant motion; light flag extends ...	3	10
Dust and loose paper raised (Experiment invalidated by dust being blown in and out of the dishes) ...	4	15

At least three sets of exposures should be made, to ensure that the results obtained are correct measures of the normal rate of deposition and are not affected by abnormal conditions which may happen to have coincided with any one experiment. It is unlikely that the actual weights collected in separate experiments at any one site will be the same, but they should be reasonably in proportion, and each separate experiment should, independently, agree with any conclusion drawn from the whole set of experiments.

Results can usually be conveniently presented on a map, with "contour lines" of equal pollution. When shown in this form it is easy to see at a glance where *deposits* of pollution are, heaviest, though it should always be borne in mind that even in any one locality there may be, and often is, considerable variation in atmospheric pollution even from day to day, more from month to month, and most from summer to winter.

II. Suspended Solid Matter

The suspended solid matter (smoke) in the atmosphere cannot be measured so simply as deposited matter but,

nevertheless, the procedure to be followed is still quite simple. A measured volume of air is drawn through a white filter paper and the suspended matter is trapped on the paper, producing a dark stain. The darkness of this stain is a measure of the amount of matter suspended in the air. Because the nature of the suspended matter may vary in different parts of the country, according to local circumstances, the proportion of light to dark particles may also vary and may produce stains of different intensities. Nevertheless, it is convenient to make use of calibrations made by the late Dr. J. S. Owens on the air of London to estimate the weight of matter making up the stain simply by visual estimation of the intensity of the stain. Although such estimated weights may not be entirely accurate in provincial districts, they may be taken as a reasonably close approximation and should show the relative amounts of suspended matter at a number of sites in any given locality.

The equipment required is:

- (i) a hand air-suction pump of capacity about 200 cu. cms. (The pump should, preferably, have a foot rest like the familiar stirrup pump);
- (ii) a pair of brass tubes of $\frac{1}{8}$ in. bore, each provided with flat ends between which a filter-paper may be clamped;
- (iii) a supply of suitable white filter paper;
- (iv) a standard scale of shades (Dr. Owens' scale) obtainable from Messrs. Casella, Fitzroy Square, London, W.1).

(i) and (ii) should be connected up as shown in the attached drawings, with a filter paper at *A*. The volume of air drawn through the filter paper at each stroke of the pump must first be measured accurately. This may be done by connecting the inlet pipe *B* to the apparatus shown in Fig. 2. It is only necessary that the measuring jar or flask *C* shall have a capacity greater than the intake of the pump. Care must be taken to ensure that the end of the tube *D* *inside the measuring jar* is level with the surface of the water in the water reservoir *E*. This water surface is maintained at a constant level

by running in tap water fast enough to ensure that there is always an overflow even when the pump is being operated. A little water is sucked over into C, by mouth suction, and the tube F connected to the pump while the piston is depressed as far as possible. The piston should now be raised and the volume of water drawn over into the jar C measured. The mean of the readings for, say, three separate tests will provide a working measure of the intake of air at each stroke of the pump. To measure the concentration of suspended solids a clean filter paper is clamped at A and the inlet pipe B is left open to the atmosphere out of doors. The piston of the pump is raised and lowered for a number of times, so that air is drawn through the filter paper.† The exact number of times will depend on the degree of pollution. Ten strokes may be enough if the air is heavily polluted although 100 may be required if the pollution is light. It is essential that a recognisable stain be produced. The area of the stain should be measured and, from comparison with the standard scale of shades, the weight of deposit determined. Then since the volume of air drawn through the paper is known, the pollution may be defined in terms of milligrammes per 100 cu. metres of air. For a survey, a number of these estimations should be made at intervals of $\frac{1}{2}$ to 1 mile over the area to be investigated.

The concentration of smoke in any district varies very much from day to day, and even from hour to hour, so that each set of observations should be made in as short a time as possible. Ideally, they should be made on a day of consistent weather, between 11 a.m. and 4 p.m., since at this time the pollution is generally fairly constant.

In general it should be noted that the absolute concentration of smoke depends on the rate at which air at ground level is replaced by clean air from above. It is greatest on days when the air is not turbulent, and least on days of high turbulence. If light winds are blowing the distribution of smoke in a district is most uniform

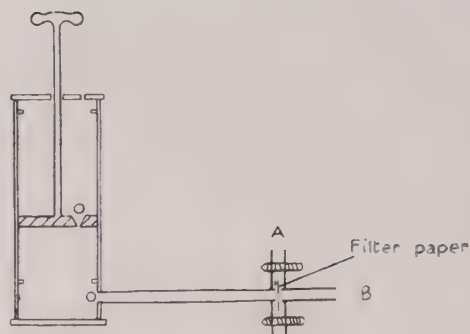


FIG. 1.

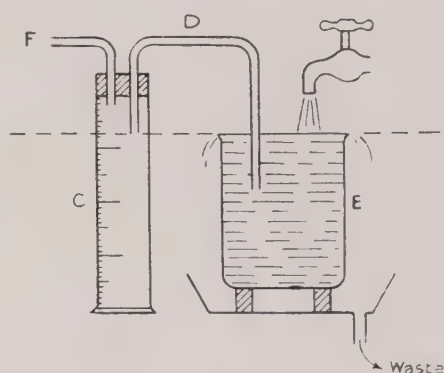


FIG. 2.

when the air is not turbulent and most closely identified with the distribution of smoking chimneys when it is turbulent. Smoke surveys will therefore provide most information about the general level of smokiness when made on "non-turbulent" days, and most about the location and importance of individual sources of pollution on "turbulent" days. Although the direction of the wind necessarily affects the distribution of smoke, it is not of particular importance in a built up area.

III. Sulphur Dioxide

There is no simple method available for measuring sulphur dioxide concentrations so quickly as deposited or suspended solid matter, although a survey can be carried out over a period of a few months.

The "lead peroxide" method of determining sulphur pollution is described fully in "Investigation of Atmospheric Pollution, Report on Observations in the Year ended

†At the top of each stroke, the piston should be kept in position until the pump is completely filled with air, i.e. until there is no longer any pneumatic pull on the handle.

March 31st, 1932" (Eighteenth Report) (H.M.S.O., price 5s.).

It will therefore be sufficient to say here that a standard surface of lead peroxide is exposed to the open air (but protected from rain) for one month. It absorbs sulphur dioxide in proportion to the concentration in the air, forming lead sulphate. The weight of lead sulphate is estimated chemically.

The lead peroxide method is widely used for routine observations of sulphur pollution. It is also very suitable for making relatively rapid surveys of sulphur dioxide concentration in a district. Instruments should be placed $\frac{1}{2}$ to 1 mile apart, and the measurements continued if possible for five summer or five winter months.

Like smoke, sulphur dioxide varies in concentration from summer to winter, because an appreciable proportion of it is produced by domestic fires.

The Department of Scientific and Industrial Research will be glad to advise local authorities or other bodies which may contemplate making surveys of atmospheric pollution on the choice of appropriate sites or the conduct of such surveys. Any correspondence should be addressed to:—

The Secretary,
Atmospheric Pollution Research
Committee,
Department of Scientific and
Industrial Research,
Teddington,
Middlesex.

HALF SPEED ONLY?

During the past year the Society has been able to increase its activities to something approaching half-speed. Now the time has come to go full-speed ahead. So much may be done in the immediate future that may never again be possible.

But even the return towards half-speed has meant a strain on our funds. The accounts for the year ended 30th June, 1944, recently audited, show a small increase in subscriptions and a much larger increase in expenditure.

- *There is, in fact, an excess of expenditure over income of almost £200.*

This gives added weight to the Appeal, which most members will now have received, for help towards a substantial increase in our annual income. Our reserves would help us to continue at half-speed for a time, but they are too small to make possible anything but the briefest spurt at the rate required.

The response to the Appeal will determine whether the Society is to creep along at half-speed only, or is vigorously to steam ahead and do its job effectively.

SMOKE PREVENTION ABSTRACTS

A selection of Abstracts of recent papers and publications of interest. Acknowledgments are made for those taken from indicated Abstract sources.

17. District Heating and its Economic Relation to Housing and Town Planning (D. V. H. Smith, *Heat. Vent. Eng.* **17**, 421, May, 1944). An urgent presentation of the case for district heating in post-war housing, using a low-pressure hot water system. A summary of costs for four existing schemes is given, together with the annual accounts of the Dundee installation. The author indicates advantages that include the prevention of smoke, diversion of £240 millions of work from the overburdened building trades to engineering trades, a material addition of electricity resources, and an annual reduction in fuel expenditure by the public of from £15 to £30 millions.

18. Heat Insulation in Domestic Building (S. F. Newcombe, *Journal R.I.B.A.*, August, 1944). The author discusses the requirements and methods of insulation with full practical information and calculations needed by the architect or builder. The warmth factor, savings in costs by insulation, and costs estimates are considered. An appendix lists insulating and building materials and gives data on their heat and other physical properties.

19. Fuel Education and Domestic Heating (E. W. Smith, *Gas World*, July 8th, 1944, **121**, 40-41). In an address to the Women's Advisory Committee on Solid Fuel, Dr. Smith emphasised the need for more education in the use of fuel, especially with regard to domestic heating, and made a plea for making fuel and domestic science compulsory in every school during at least the last year.

20. An Outline District Heating Scheme for London (A. Margolis, *Engineering*, May 26th, 1944, **157**, 401). The possibilities of a district heating scheme are considered in the light of reconstruction proposals in "The County of London Plan," and conditions in 1960 are visualised. The new utility would have the advantage that, in fulfilling the primary task of heat supply at the low cost of 3½d. per therm on the 1938 price basis, for direct use, in contrast with any fuel,

with its unavoidable combustion losses, it would simultaneously eliminate the smoke nuisance and its evil consequences. Electric power generation would be extended on an unprecedented scale and great quantities of coal would be saved.

21. Future Coke Development (*Gas Journal*, August 16th, 1944, **244**, 211). A report published by the General Committee of the National Federation of Coke Associations. The structure and functions of a co-operative organisation envisaged by the Committee are outlined. These functions would include the co-ordination and regulation of coke prices, the study and development of existing and new markets for coke, the provision of smokeless fuel, the encouragement of the design and production of satisfactory fuel-burning apparatus, and the maintenance of the position of the gas coke industry in relation to the solid smokeless fuel industries.

22. The Formation of Land Fogs and the Atmospheric Pollution of Towns (N. Pye, *Geography*, September, 1944, **145**, 71). The author discusses, with special reference to teaching, the formation and nature of fog and stresses the part played by air pollution. It is pointed out that during a smoke fog the smoke particles near the top of the fog absorb a large proportion of the sun's rays and thus increase the air temperature at the top of the fog layer. The result is to strengthen the inversion, and in this way fog may persist all day over large towns while in the country it yields to the influence of sunshine. Methods for the teaching of this aspect of weather study are suggested, as are the taking of observations by school children. Reports coming in from the different parts of a city or other large area can be valuable in building up a picture of the growth and distribution of fog. The author states that education in smoke abatement should be incorporated in the normal school-courses in other subjects and much useful work towards this end can be done in connection with weather study.



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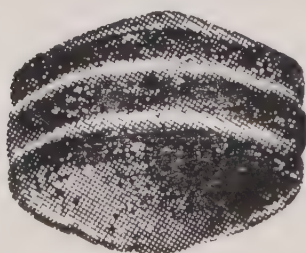
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*Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky ;
All bright and glittering in the smokeless air.*

SMOKELESS AIR

The Conference

As this number will go to press before the Joint Conference on Air Pollution of the Society and the Institute of Fuel, which is to be held on February 23rd, a report of this important meeting will have to wait for our Summer issue. We hope then to be able to give a full account of what promises to be an address of especial importance: the opening of the conference by Major the Rt. Hon. Gwilym Lloyd George, M.P., Minister of Fuel and Power. It is very encouraging that the Minister should have accepted the invitation to open the proceedings and it is perhaps a further indication of the increasing interest in the smoke problem now apparent in his own Ministry and other Government departments.

Sir Ernest Simon

Members of the Society, and especially those who were originally members of the former Smoke Abatement League, will have been pleased that Sir Ernest Simon should have been appointed chairman of the new Fuel Advisory Council appointed by the Minister of Fuel and Power. Sir Ernest is a Vice-President of the Society and in its early days in Manchester was honorary secretary of the Smoke Abatement League. He was a member of the Departmental Committee on Smoke and Noxious Vapours Abatement, of which Lord Newton was chairman, and with Miss Marion Fitzgerald wrote a short book on the problem, "The Smokeless City." It has been a matter of regret that Sir Ernest's active work on smoke abatement should have been

curtailed in recent years by his study of housing and other questions. Perhaps we may express our hopes by saying that we trust that in his new appointment his wide knowledge and understanding of the smoke problem will be found to be of practical use.

American Tribute

The 1944 annual meeting of the Smoke Prevention Association of America was held at Detroit in June. There was a full agenda of 27 papers and addresses, most of them of a technical nature, during the four days of the meeting. Among the resolutions adopted at the close of the convention, we have been warmly gratified to read, was the following :

"Whereas the National Smoke Abatement Society of the British Isles has continued its cordial relationship with this Association and its members under most trying conditions, and whereas Smoke Abatement work in England has been signally sustained and progress made while defending the freedom of humanity, now, therefore, be it resolved : that the Smoke Prevention Association of America, Inc., extend its greetings and felicitations to our brothers across the sea with all best wishes for further progress in atmospheric pollution."

The scope of the papers was wide and the published volume of *Proceedings* is a further valuable addition to the Society's library. As is usual at these meetings, railway smoke received particular attention, and other papers dealt with post-war problems of coal conservation, fuel research, and city planning. There were short papers on the weather and air pollution, and meteorological factors affecting pollution. A paper by the Chief Smoke Inspector of Detroit reviewed the work that had been done in that city on the measurement of pollution. A specially designed copper receptacle for the collection of deposit is used. Figures given show a remarkably low soot-fall for an industrial city, the average for the area surveyed varying from 41 to 87 tons per square mile during the past six years. Either Detroit is exceptionally free from smoke, or the method used gives results that cannot be closely compared with those obtained in Britain and other U.S. cities. International standards in the methods of

air pollution measurement would be a useful step forward, and could perhaps be the subject of still one more agreement between the U.S.A. and Britain.

Merseyside of the Future

Under this title a most interesting report has been published of a competition organised by the Merseyside Civic Society and the "Liverpool Daily Post." The competition invited new and practical suggestions for improving the amenities of Merseyside and sought—it appears with great success—to ascertain the views of Merseyside people as to the improvements they want. It seems to have had a large response, and ten thousand ideas were received. These are analysed and described in the report (published by the Daily Post and Echo, Ltd., 2s. 6d.). Smoke abatement, it is gratifying to find, appears to have received excellent attention, and the following extract is in fact a remarkable sign of the growing public feeling about smoke : "In the Health group there were more entrants who suggested abolishing smoke than there were entrants stressing the need for abolishing the slums, though these two themes were by far the most popular."

The entries were considered in a series of Group Discussions, and in a report of the Health Group discussions the note is made : "Smoke abatement rather from aesthetic than medical reasons (a man cannot think cleanly in a pigsty)." This is a rather interesting point of view to have been put forward, and is important to us as a guide to the public approach to the problem.

From a special schools competition we like the entry by Brenda Dewsnup, who "held that cleanliness and co-operation to be the two essentials. She would abolish smoke, and mice too, from the vicinity of houses . . ." We believe this is the first time that smoke has been bracketed with mice, but after all, as nuisances, they have much in common.

The Appeal

The Society's development appeal is making progress, although this must be measured so far in hundreds rather than in thousands of pounds. Including donations, some of which may not be renewed another year, the new money so far received is now approaching the

£700 level. New members are being obtained, particularly, so far, from among gas undertakings. There are also more than two dozen newly affiliated local authorities. Considering all the difficulties of the present time this is not unsatisfactory, though we have a long way to go yet before we achieve the income we need. However, the drive will continue, and there is still much more to be done. We shall be disappointed if we do not at least double our previous income within the present year.

New Housing

The Society has prepared and sent to all Local Authorities throughout the country a memorandum on "Smoke Abatement in New Housing." This draws attention to the recommendations of the Housing Manual on the subject and gives notes that it is hoped will be of practical value to those concerned. These, of course, are mainly concerned with the vexed question of the open fire. The memorandum points out that "the matter is of urgency even in areas at present relatively free from the effects of air pollution, for unless the necessary steps are taken, extensive new housing developments will create their own smoke palls to the detriment of these new districts and neighbouring property or agricultural land." The memorandum concludes by saying that "the Society trusts that Local Authorities will fully appreciate and act upon the recommendations for increased efficiency and reduced smoke in new houses. The Society exists for, and is concerned only with, the benefits to the community of the restoration of clean air and is very anxious that the coming opportunities should not be neglected." The offer is made to co-operate "in attaining an end that will result in a cleaner and pleasanter and therefore

happier life for the citizens of our towns." The memorandum has not been distributed among members of the Society but we shall be pleased to send a copy for information to any member who is interested.

Wanted

The Society's offices are busier to-day than ever before and we urgently need a further typewriter. As even second-hand machines are difficult to obtain and prices are unduly high, we would be grateful to any member who might be able to loan for the time being any typewriter not in use. Either a standard model or a portable would be suitable, but if any offer should be made we would first like to have particulars.

New Publications

The Annual Report, covering the year 1944, will shortly be issued to all members. Other readers may obtain a copy on application (2d. post free). We also hope to publish in the near future an important booklet on *Smokeless Zones*. This will explain in some detail the Society's proposals on this method of achieving smoke prevention and will discuss the practical questions that will arise. The price will be sixpence. Thirdly, in course of preparation is the first of a series of booklets designed to help school-teachers to include smoke abatement information in the course of ordinary school lessons on relevant subjects. The title of the first booklet, which will be illustrated, is *The Smoke Problem in Science Teaching*. Others in this series will be on smoke in relation to health and hygiene, and domestic economy.

The "Smokeless Air" frontispiece photograph in this issue is a view of Stockholm.

SMOKELESS AIR. Wartime Issue No. 19 (Vol. XV, No. 57). Spring, 1945. Published quarterly by the National Smoke Abatement Society. Editor: Arnold Marsh, M.Sc.Tech., M.Inst.F. Address: Chandos House, Buckingham Gate, Westminster, S.W.1 (Telephone: ABBey 1359).

Gratis to members. Subscription rate: 2s. 6d. per annum, post-free.

SMOKELESS AIR is the official organ of the Society, but the views expressed in contributed articles are not necessarily endorsed by the Society. Abstraction and quotation of matter are permitted, except where stated, provided the usual acknowledgments are made.

THE OUTLOOK FOR SOLID FUEL

The Question of Smoke

Post-War Building Studies No. 10: Solid Fuel Installations, by a Committee convened by the British Coal Utilisation Research Association. Published for the Ministry of Works by H.M. Stationery Office, pp. 48, 9d. net.

THIS is one of a number of reports by Committees set up as part of a scheme initiated by the Ministry of Works to secure a comprehensive and co-ordinated review of building technique for the guidance of those concerned with building after the war. The Solid Fuels Installations Committee included representatives of many of the fuel, manufacturing and professional associations concerned, and its membership shows a high concentration of expert knowledge on all aspects of domestic heating with solid fuel. A strong faith in the future of solid fuel for domestic purposes is naturally to be expected from a committee of this kind.

The terms of reference included the review of existing information and practice concerning accommodation and installations for solid fuel burning appliances in the single-family dwelling; to review proposals for improved appliances and to make recommendations for practice in post-war building having regard to (a) economy and efficiency in use and (b) reduced emission of smoke from dwellings.

The question of smoke was thus an integral part of the Committee's inquiry, even though the directive was reduction rather than prevention.

The scope of the report includes a consideration of objectives in the design of appliances, with recommendations and a survey of future developments required, economies to be expected from improved appliances, the installation, distribution and servicing of appliances and what is called "consumer education," the characteristics of domestic solid fuels, and objectives relating to building and

architecture. A series of appendices deals with recommended standards of performance, smoke abatement, comparative examples of operating cost for existing and improved appliances, practical questions relating to the installation of appliances and the design of flues, and finally a selection of types of appliances.

It will thus be seen that the ground is covered in a thorough and comprehensive way; in such a way, in fact, that it is impossible to summarise either the arguments or findings of the report. All that can be attempted is to select a few of the more important points raised.

Freedom of Choice

The report opens with a few paragraphs on the factor of freedom of choice of the consumer in the matter of fuel used. While agreeing that the householder should be given the fullest freedom compatible with the general housing and fuel policy, the report considers that this limitation is considerable and it mentions in particular (i) the need for low cost housing, which must be impeded if houses are equipped with all alternative forms of heating, (ii) the need, in the national interest, for smoke abatement, and (iii) the question of peak loads arising from sudden climatic changes or the unbalanced development of a particular fuel. "The economic use of our national coal resources requires that the most appropriate fuels should be used for each particular purpose, and the development of a national fuel policy may therefore necessitate some limitation of the principle of freedom of choice."

From the smoke abatement point of view it might be pointed out that the national interest includes the freedom of the citizen to breathe clean air and to enjoy a clean environment, and not to have one's personal property soiled and damaged by the action of one's

neighbours. These freedoms, we suggest, are more fundamental than the freedom to pollute the atmosphere.

The Cost Factor

It is admitted by the Committee that progress in the design of solid fuel appliances has been unduly slow, and this is attributed to the demand for cheapness in the inter-war period. "We feel that we cannot emphasise too strongly that low capital cost of appliances is not an economy, either to the individual or to the nation, if it is accompanied by high fuel consumption, with the result that the overall cost of heating or cooking (after making due allowance for capital charges) is increased . . ." The report discusses in some detail the economies to be expected from approved appliances, and gives a table showing the justifiable increase in the price of an appliance corresponding to a given annual saving in fuel obtained by increased economy. Thus if an appliance gives an annual fuel saving of £1 5s. it is justifiable for it to cost £10 more on a life of ten years, or £17 on a life of 20 years. In continuous heating appliances, which the report strongly favours, the saving in fuel may be very little over pre-war appliances, but there would be the advantage of space-heating and hot water at any time. The saving in the cost of smoke is also borne in mind :

"This represents a further important advantage from the national point of view. The annual fuel consumption of the continuous-burning space-heating appliance is estimated in Appendix III at 1.76 tons, and on the basis of the comparative figures for cost of damage caused by atmospheric pollution given in that Appendix, the annual saving on this account may be estimated as approximately 8s. 10d. per fire per annum, the corresponding figure for the multiple-duty appliance being £1 6s. It should be noted that the estimates referred to take into account only the assessable damage due to pollution by smoke and sulphur. The unassessable damage is probably considerably greater than the assessable."

Objectives

Recommendations for the design of appliances are made with respect to objectives listed as follows :

(i) All-night burning (e.g. ten hours without refuelling).

(ii) Speedy preparation for service. This means rapid burning up and availability of heat for the required purpose and can be obtained by continuous-burning appliances.

(iii) Smoke reduction with bituminous coal. "We consider that the immediate objective should be to reduce smoke emission below about 1 per cent. of the fuel burned. It has already been shown by experimental work that a very considerable reduction in smoke emission from domestic appliances can be obtained by appropriate design and draught control . . . the results which will be obtained depend not only on the appliance manufacturer but also on the architect, the builder, and the user of the appliance."

(iv) Improved thermal efficiency of appliances. It is considered that with improved open fires and the use of convected heat it should be possible to obtain efficiencies of 45 per cent. or even higher.

(v) Effective use of solid fuel for multiple duty. "By the increased use of insulation on cookers and hot-water systems it is possible to make a single fire supply a large part of the domestic heat requirements without the waste of fuel which has in the past so often been associated with the use of multiple-duty appliances."

(vi) Reduction in the labour and attention involved.

(vii) Ease of cleaning.

(viii) Burning a wide range of fuels. Fuel capacity should be sufficient to permit continuous burning when using either bituminous or smokeless fuel.

Future Developments

The development of appliances, it is considered, involves improvements which may add to their first cost. Standardisation of comparable parts is desirable, and quantity production technique is desirable but can be attained only when there exists a large-scale predictable and steady demand. Further :

"If maximum efficiency, effectiveness, and convenience in the utilisation of solid fuels are to be realised, it is necessary to consider not only the appliance itself and the characteristics of the fuel used but also the structure of the whole house and each individual room. Only if the building as a whole is regarded as a heat-using machine can heating and cooking appliances

be designed which will give the fullest service for the lowest consumption of fuel."

Smoke Abatement

Appendix II of the report is on smoke abatement, and from our point of view this is of especial interest in that it is the fullest examination of the domestic smoke problem yet made by a committee representing solid fuel interests. Smoke pollution may be reduced, it is said, through (i) the use of coals which are smokeless naturally or by virtue of carbonisation, (ii) the better cleaning and preparation of coal (particularly for reducing the amount of iron pyrites, which gives rise to sulphur dioxide emission) and (iii) through more complete combustion of raw coal.

It is affirmed that the supply of natural smokeless fuels is limited, and that of carbonised fuels relatively small and unlikely to be increased sufficiently rapidly to make an important contribution to smoke abatement in the near future. The importance of coal cleaning is stressed, and emphasis given to the importance of reducing sulphur

question of air supply—the size and shape of throat, chimney draught, control of primary air, rate of combustion and use of preheated secondary air. The last may either increase or decrease smoke. Then the operation of the fire is considered: wood and paper ignition shows both higher and lower smoke production compared with gas ignition. The practice of fuelling "little and often" is of help, and continuous burning should clearly result in smoke reduction. Tests with a continuous burning appliance have shown smoke reduction of 58 to 70 per cent. compared with the stool-bottom grate. Increased depth of fuel bed gives increased smoke unless secondary air is provided. An interesting point, though its practical application is not discussed, is that tests have shown that ignition is accelerated when water vapour is passed through the fuel bed.

The Cost of Smoke

A table is given, as follows, to show the comparative cost of damage caused by air pollution due to domestic smoke:

	<i>Existing Appliances</i> (2.6% smoke, 0.4% sulphur)				<i>Improved Appliances</i> (1% smoke, 0.4% sulphur)		
	2	4	6	8	2	4	6
Fuel consumption, tons per year
Cost of damage caused by air pollution per year	15s.	£1 10s.	£2 5s.	£3	7s.	14s.	£1 1s.

pollution, "which is probably responsible for as much damage as smoke." The immediate objective in the more complete combustion of bituminous coal is to reduce smoke emission below 1 per cent. of the fuel burned, "though its attainment is with some arrangements dependent on the builder and the user of the appliance as well as on the appliances manufacturer." Reference is made to work for the development of a smoke-reducing grate, which it is said is not yet complete. But tentative conclusions have been reached and the principal features likely to affect smoke production are summarised.

Among these factors there is first the size, volatile matter content, and caking properties of coal. The insulation of the fireplace and form of fireplace are important, and here the higher the general temperature that can be attained the less is the amount of smoke produced. Much depends also on the

A footnote explains that the damage is estimated at 2s. 6d. per ton of fuel burned for each 1 per cent. of pollution. For purposes of comparison it is assumed that pollution emission is 3 per cent. of the fuel burned (2.6 per cent. smoke, 0.4 per cent. sulphur) in existing appliances, and 1.4 per cent. of the fuel burned in improved appliances designed for smoke reduction.

It would have been useful if the source and basis of these estimates had been given. They appear, however, to be of a reasonable order, and mean a total cost of domestic smoke in the region of £15 millions a year.

Conclusions

Considering the report from the Society's special point of view, it may be said that it is an important and helpful document, and that it marks a further step in the recognition of smoke abatement in the way that the Society has been demanding for many

years. Although it is concerned only with smoke reduction the improved appliances it envisages have the merit of being equally, or even more, suitable for smokeless fuels. Given the general introduction in new houses of these appliances there will be an immediate reduction in smoke emission, and subsequently there can be a further advance by the use of smokeless fuels in place of bituminous coal. To what extent, and when, the second stage is reached will depend on the increase in production of smokeless fuels, their price and quality, and the steps taken to popularise and encourage their adoption.

Provided that this second stage is appreciated and kept in mind as the real objective, the smoke abatement movement has everything to gain by supporting the development and general use of improved appliances which will at first mostly burn bituminous coal. The alternative is not, in the immediate future, the universal use of smokeless fuels, but the use of bituminous coal in cheaper appliances that will neither reduce smoke nor prove suitable for the future change-over to smokeless fuel.

Chimney Insulation

*The Editor,
"Smokeless Air"*

Sir,

Thank you for sending me *Smokeless Air*, with a note on my article in the R.I.B.A. Journal. I see you are to review Post-war Building Studies, No. 14, on Solid Fuel Installations.

Paragraph 148.4 of this Report (and *Coal Research*, September, 1944) state that the brick chimney is good enough for its purpose, though it loses 310 B.Th.U. per ft. run, or 2.3 deg. per ft. run, consuming $2\frac{1}{2}$ lbs. of coal per hour and 6,000 cub. ft. of gases per hour.

A correctly lagged flue with $U = 0.10$ and heat capacity about $2\frac{1}{2}$ lbs. per ft. run would have an inner surface warmed up in about 6 minutes, whereas the 9 in. x 9 in. brick chimney takes some 4-5 hours. The lagged chimney would thus ensure (a) quick lighting up and hence reduced smoke, (b) better draught control and therefore control of combustion, and (c) reduced condensation and sulphur attack.

There is no advice given re the obvious need to insulate all fireplaces fixed to external walls, especially necessary for coke fires which require low heat capacity grates to speed up lighting. The less leaks there are the more heat is available as and where it is wanted.

Yours, etc.,

S. F. NEWCOMBE.

District Heating and the Smokeless City

The case for district heating, and the way in which it would bring nearer the smokeless city, was convincingly made in a paper to the Royal Sanitary Institute by Mr. D. V. H. Smith at a London meeting on November 15th, 1944. There are six schemes working in this country which can be described as district heating, but only three of these are of any size with independent boiler plants used solely or mainly for district heating. These have been in operation from 33 to 22 years and are giving satisfactory service to-day. On the continent progress has been much more rapid and in 1939 over 200 systems were in successful operation.

Mr. Smith examined the objections that have been put forward and gave a brief catalogue of the advantages. These included: (1) District heating would absolutely prevent the smoke evil in all new building schemes where adopted. (2) Cheaper and lower-grade fuels can be used, leaving high-grade fuels for processing or for export. (3) More heat at less cost. (4) No more damp houses. (5) Improved health due to (1) and (4). (5) Relief to overburdened housewives. This item, said the author, has much more significance than mere saving of labour would imply. We were building larger houses, with more rooms, but what was the use of providing an extra room if occupiers could not afford to keep it dry and warm enough to be healthy?

Reference was made to the schemes working at Dundee since 1920 and 1922, to which the Scottish Housing Advisory Committee drew attention. Here the charges to the tenants are 3s. per week for a two-apartment house, and 3s. 9d. for a three-apartment house, and these

(Concluded on page 59)

SMOKE ABATEMENT IN THE SCHOOLS

A Prize-Winning Essay

MR. R. H. CLAYTON, a member of the Society's Executive, offered prizes to the Manchester High School for Girls for essays on "The Advantages of Clean and Unpolluted Air to City and Suburban Dwellers, with Special Reference to Manchester." Following is the essay which won the first prize. We hope to publish another of the essays later.

Mr. Clayton's initiative has been followed by similar offers to other schools by members. We commend the idea to all our members who may be prepared to encourage a study of the subject in schools in which they may be interested. The Society will be glad to assist.

1st Prize—by Marjorie C. Findlay

*"Preserve me from the shape of things to be,
The high-grade poster at the public meeting,
The influence of art on industry,
The cinema with perfect taste in seating,
Preserve me, above all, from central heating
It may be D. H. Lawrence hocus-pocus
But I prefer a room that's got a focus."*

So says W. H. Auden; and it is an all too obvious truth that the Englishman is highly attached to that coal fire which is traditionally the centre of the family circle. Yet domestic fires are said to be responsible for three quarters of the smoke which pollutes the air of our industrial towns and brings in its train so many other evils. To Mr. Auden, therefore, and others who hold his views, one would like to point out some of the changes city people would see, were the production of smoke by burning raw coal reduced, in the hope that they may find the subject worthy of a second thought.

We will assure the reader that the results would be highly beneficial, for they are based on the increase of health, economy and happiness, goals at which most of us aim.

How, then, does our coal-fire harm the nation's health, and what good will ensue if we do away with it? The combustion of raw coal in our hearths produces ash, and an enormous amount of smoke, which with the particles of tar and acids that it contains, makes its way up our chimneys and collects to form a thick pall over the district. Such clouds either absorb or reflect a considerable part of the heat and light radiated from the sun, with the result

that, over big cities such as Manchester, we receive less than our fair share of sunshine and the very brightness of the light is diminished by the blanket which casts its gloom over the towns. For the effect this has on health, one has only to compare the children who spend their young lives in the towns with those who live in the country. Although they may be equally poor, the latter are browner and sturdier, capable of withstanding greater hardships, the result of living in clean air, through long hours of sunny weather. They present a great contrast to the white-faced children of the Manchester streets, who are in constant need of the vitamins and building foods which they do not always get.

Manchester is particularly unfortunate. As true Mancurians we are bound to refute the tales of her weather; and in one respect they are undoubtedly mistaken. It is not so much that at Manchester it is "always raining," but that it is nearly always gloomy and usually drizzling, a result of the high relative humidity prevailing in Northern Britain combined with the presence of smoke over Manchester, which provides the particles (carbon, etc.) on which water may condense, when a drop in temperature causes saturation point to be reached. The drizzle, which descends when the clouds so formed become too heavy is bad enough. It is not the quick shower which lasts half an hour, watering the ground and refreshing the atmosphere, but a fine penetrating rain which makes everyone thoroughly damp and uncomfortable. Wet clothes must be removed and

dried in an atmosphere which is already humid, or if one sits in them colds, chills, rheumatism and pneumonia may be the result. It is interesting to note that although not all are crippled by it, most Manchester people have occasional twinges of rheumatism.

Fog

But the fog, which we suffer when the condensation is insufficient to produce rain is infinitely worse. The usual colds, etc., become rampant in foggy weather, because our resistance is lowered by the uncomfortable feeling of dampness, and by the fact that we have to breathe more quickly, for oxygen is more soluble than nitrogen in water, and we must take in more air to obtain the normal amount of oxygen. This is also true during drizzle, but there are worse effects of fog, viz. the clogging of the respiratory organs with moisture, the inclination to headaches in the heavy atmosphere, and worst of all, the limiting of visibility. It is common knowledge that the accident rate goes up during foggy weather, and incidentally, that vehicles, moving slowly to avoid accidents to life and limb, cause a slowing up of transport and consequently of factory production. Moreover, the situation is made worse by the filthy colour of the fog, the "real pea-soupers" of October and November, which not only limit visibility further, but deposit grime on everything they touch.

Dirt is the final weapon which smoke launches in its attack on health. Even in dry weather its particles fill the atmosphere. We find it inside the house, settling as dust on window ledges and picture-frames, and it is everywhere in the air, taken into our lungs with every breath so that they become gray instead of pink and encourage lung complaints. In damp weather, it changes a white fog formed by natural phenomena to one of the darker hues already referred to, making yet greater difficulties to drivers.

One must also consider the effect of dirt on vegetation. Although not directly a matter of human well-being, it is so indirectly as it affects his food. The dirt in the atmosphere settles on hedges, trees, vegetable plots and flowers, clogs the stomata of the leaves and so hampers the natural processes of respiration and transpiration which

the plant must carry on if it is to flourish. It has been proved that radishes grow better in the country than in town air and it is safe to say that this rule applies to other plants. Man must therefore buy more seed, take greater pains and work longer hours in the allotments of industrial districts than he would need do if he lived in the country.

This is a wasteful expenditure of money and labour, and is therefore part of the answer to our next point—how can we practise greater economy by refusing to light coal fires. But it is a very small part of the answer and not one which concerns the housewife who can benefit most in the cause of economy.

The Housewife's Labour

First, economy of labour. Any woman who has kept house in an industrial town knows that if she dusts her living-room one day and has a fire in the evening, or leaves her windows open, the job will certainly have to be done again next day. Houses in such parts need cleaning throughout every day if they are to be kept really spotless and curtains must constantly be washed; and not only household linen, but all our garments and undergarments are soon soiled by this all-penetrating grime. Office girls can wear their light-coloured blouses for a single day only, while they are at work, whilst in the comparatively smoke-free air of the seaside they can be worn two or even three days. If the washing is done at home, consider what time and trouble would be saved if our clothes were not made unfit for wear in half the normal time on account of that fire in our grate.

Or if the clothes are sent to the laundry?—there again our bills would be substantially reduced; and again one may say that it has been proved, that in the small town of Harrogate where there are far fewer domestic fires, people spend less on laundry than in Manchester. Towns themselves would be cleaner. Fewer road-sweepers would be needed to clear away a smaller amount of refuse from the streets, and building would not need their periodic cleaning, to remove the accumulation of carbon which does so much to give Manchester a dismal aspect. It is possible that the money saved by the

Manchester Cleansing Department could be expended in the building of the extra secondary schools which are so badly needed.

Of the economy of labour which could be practised by the use of central heating, gas or electric fires instead of coal fires we will not speak. To the devotee this must be regarded as a labour of love, and it is certainly a matter for his own free-will.

Of its effect on his mental and spiritual well-being, much must be said. I myself can think of nothing more dismal than the periodic train journeys which I make from North Wales to Manchester. One boards the train in clear weather, where it is usually sunny and the air is always fresh, but as the train passes through Chester, Earlestown and Patricroft the accustomed gloom sets in. There is usually less wind to renew the atmosphere. It is darker, and there is a feeling of heaviness which contrasts sharply with the brightness of the coast.

One would not suggest that Manchester could attain the atmosphere of the seaside resort, for sea influence is less felt in Manchester; but imagine the shrubbery of St. Mary's Parsonage a pleasant green instead of the black which now exists. Imagine Piccadilly gardens (extended, by the use of money saved in cleaning the streets, to cover

the blitzed area) looking gay and refreshing all the year round instead of for those few solitary weeks when flowers make a bright splash of relief from the black walls and buildings which surround the square. The buildings themselves would be their natural white colour; there might even be birds in the public gardens; and the whole would be bathed in the warmth of the sun, or alternatively, washed by clean rain.

That, of course, is the ideal, and takes no account of the modicum of bad weather which is bound to occur from time to time. But the dirt-laden drizzle can be lessened and the yellowish fog abolished. Let the sceptical reader consider Helsinki or visit Welwyn Garden City, in which there is very little smoke, so that the weather is brighter and the town cleaner. Welwyn Garden City is not a blot on the landscape; in fact its presence, when several miles away, is indiscernible.

These are not fanciful imaginings, but practical possibilities; possible too, within the century, if the proper measures are taken when rebuilding takes place after the war. Therefore, while allowing the Englishman a "focus" of one sort or another, and never questioning the right to use his own judgment, we would ask him to look into the matter and keep an open mind.

Verses to the Editor

The Editor,
"Smokeless Air"

Sir,

What a blessing it would be
 For city folks like you and me,
 If all the dirt that comes from coal
 To darken body, mind and soul,
 Were kept within the pit's confines,
 Where at the best sun never shines:

If smoke were banished from the air,
 That we might see our townships fair
 With streets and houses bright and clean
 And grass and trees of Nature's green;
 Children with eyes and colour bright,
 Not dull, nor grey and pasty-white;
 No woman's back untimely bent
 In never-ending punishment

Pursuing still the larger hope
 Of miracles from patent soap:

If everywhere from Leeds to Crewe
 A man might see a decent view;
 If sheep near Sheffield could be white,
 And day were not the same as night
 In ***; if no smoke-screen dun
 Hung between *** and the sun;
 If even Satan's self could tell
 The difference 'twixt *** and Hell!

Your readers, Sir, may fill the blanks,
 And you shall have my warmest thanks
 If you can find sufficient room
 To air this cry from *Nether Gloom*.

Yours, etc.,

W. C. H. NEILL.

Hearth and Home

By J. Pickston, B.Sc.

THE outstanding difference between the human race and other organisms is its exceedingly flexible power of adaptation to environment. Human beings are found in habitats ranging from hot deserts to the tundra, from pleasant village to industrial slum, and they can survive in homes penetrated by the peculiar fragrance of the camel or the inorganic effluvia of raw coal. Still more remarkable is the fact that the survivors appear to like their penance, and in fact defend it so warmly that all the impressive and conclusive evidence of, say, the National Smoke Abatement Society is powerless.

I wonder whether we in the N.S.A.S. have given enough attention to the central core of the opposition. The point that is salient is that we have all the facts of the argument on our side, and yet the jury keep returning the same old verdict. Take for example the report "Planning Our New Homes" by the Scottish Housing Advisory Committee. The smoke abatement case was put to the Committee, and the ugly facts were admitted in full:

"the use of raw coal . . . represents a gross waste of energy . . ."

"The use of raw coal in domestic grates is responsible for at least 50 per cent. of the atmospheric pollution which is so detrimental to health and amenity in our cities and burghs" (Par. 120).

With this in mind, the Committee immediately pressed for two coal fires as a minimum per dwelling, as there is "a traditional preference for the open fire" (Par. 121).

The two paragraphs quoted deserve immortality as a classic example of a form of art somewhat neglected since the days of Shakespeare. They also deserve the closest attention from the National Smoke Abatement Society; for they have the merit of throwing a searchlight on our problem. That problem is no longer a matter of building up an overwhelming case. The job of the technician in this field has been done, and on all possible sides.

I have great stacks of material on the health aspect, and cannot chisel a flaw in them, although as a matter of plain duty I have tried. Even if this had no bearing on the case, there is the economic and social case against the destruction of our richest assets. The minority who care little for these points must admit that a clean and sunny city is more pleasing than a grimy and gloomy blur.

There is the case, but the opposition is not against these arguments. It is the opposition of all forms of life, including our own, to change in the familiar environment. I suppose that the biologist and the psychologist are the people to dilate on this tendency, which in certain stages has undoubted survival-value. Nevertheless I may suggest that human beings may be so conditioned that they resist an obvious improvement on the irrational but very ancient (very "traditional") ground that it spells change.

There is only one way to meet "tradition"—the same way which has thrown so many rock-bound traditions aside (some of them very pleasant ones!). A minority of people, usually in the medium income groups, give the new idea a practical trial. If they find it useless, or tiring, or uncomfortable, the minority dwindles to a devoted band. If they find their life made more enjoyable, their friends are added to the circle, and the circle grows until it sets a definite public opinion in motion. This has been the case in developments as varied as the design of wallpaper or the spread of motoring. In other words, public tastes and traditions can be fundamentally changed, and not by technical argument but by introduction to new habits of living.

Thus it is the plain duty of the citizen who has the comfort of a smokeless home to use it as his main weapon. The technical arguments will serve for making his converts into missionaries, for there is no more vigorous advocate than a recent convert! Let the sceptic see for himself that smoke abatement

pays the householder. Let him envy the lucky fellow who enjoys the luxuries given him by modern fuel methods. Let his wife compare her drudgery with the modern way, and the grime she fights with the cleanliness of an efficient source of heat. Point out in a casual way the curtains, the carpets and the furniture. Indicate, of course, the tell-tale line of soot—from the town air coming into the room! My experience has been that this kind of approach is successful, especially as I have shown that my own particular method is one out of many possible solutions, and I have no connection

with any fuel interests. (One amusing experience was to find a man attacking smoke abatement people violently, until I pointed out to him that he had spent £70 in his own home on methods of efficient fuel utilisation illustrated in the Society's publications).

Here is a footnote. Only this week I heard a distinguished Canadian lecturer under cross-examination by British housewives. He was very frank about his choice of hearth and home. He had no use for tradition in fuel methods. "I wanted my wife to look 30 at 40 years, and not 40 at 30 years," was his final shot.

CLIMATE AND ENERGY

THE second, revised and enlarged, edition of Major S. F. Markham's book, **Climate and the Energy of Nations**, has been published in the U.S.A. (Oxford University Press) and will shortly be available in this country. The thesis of the book is one that will be of especial interest to all who are concerned with the smoke problem as one particular aspect of the broader question of climate and atmosphere in relation to human activities. Climate, and the control of climate, the author shows, are primary factors in determining the level of a nation's energy, upon which largely depends its ability, power, and culture. The great civilisations of the past came into being on or near the 70 deg. F. isotherm, round about which the most favourable climatic conditions for comfort and activity are to be found. Successful cultures have since arisen in colder climates, but only where, through buildings, clothing, and artificial heating, it has been possible to control indoor climate. Humidity, it is shown, is a factor of importance that must be correlated with temperature.

The chapters in which the subject is surveyed historically are fascinating to read, and although there is always a danger, in propounding an argument on such a broad scale, of ignoring inconvenient and over-emphasising favourable factors, Major Markham's analysis appears to be scientifically sound, and he builds up a vivid picture

of the decisive way in which climate influences our civilisation and the nature of our individual lives.

The growth of cultures based on the new and powerful agent for controlling climate, namely coal and its derivatives, is described. The real influence of coal is seen most clearly, not in this country, but in the way in which it has influenced and modified the new civilisation of North America. The relationship of climatic variations and energy within a single country is discussed with respect to the British Isles and, with naturally greater scope, to the U.S.A. Tables and maps for the latter country, showing the difference in such energy factors as intelligence, infantile mortality, income, etc., are given and are highly significant.

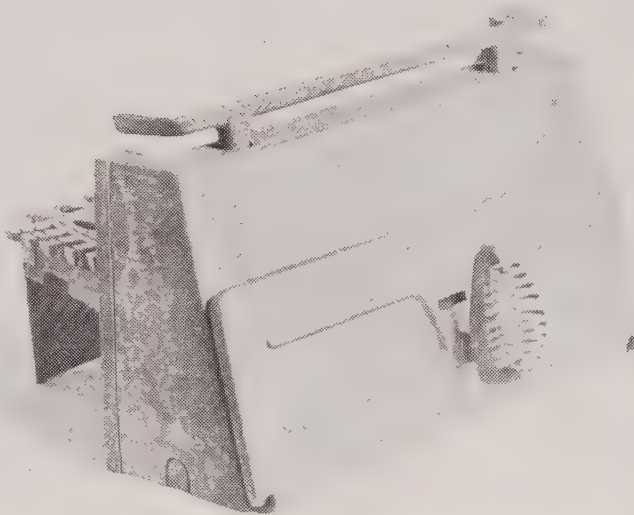
To deal wisely with the many questions of reconstruction, industrial development, social and international relations, and generally the future of our own country and of the world, both the student and the specialist must understand the facts that, beneath the immediate and often transient problems of the day, determine the essential form and nature of civilisation. Climate is one of the basic physical facts, and this book, which reflects deep and comprehensive thought, will be found to be a stimulating and engrossing introduction to a field of knowledge that has not yet been adequately recognised.

THE “CLACO” FIRE

THE “Claco” is a further type of improved fire, suitable for all forms of smokeless fuel, that we are able to describe. It will be manufactured by Charles Lathe and Co., Ltd., of Tipton.

The general appearance of the fire is shown in the photograph. The important feature of these new fires is, of course, the method for regulating, and when necessary, preventing, the supply of air under and through the fire. In the “Claco” fire the whole of the lower part of the front is hinged at the bottom, and is opened by a heat-dissipating handle. An ingenious cam arrangement pushes the damper open at the top and allows a very fine adjustment of air control. As the opening is outwards and at the top it is easy to see whether, and how much, the damper is open. In practice the handle can easily be worked with the foot.

The front is detachable, and the frame and ashpan are so designed that the whole of the ash is caught in the pan and can be removed without the need of a shovel. The frame is adjustable and will fit almost any type of fireplace using the ordinary Milner-type back



brick. A burner for gas ignition is fitted to the frame. Vitreous enamel finishes will be used and will give a pleasing appearance to an attractively designed fire.

In evolving the fire the manufacturers have worked in close conjunction with Dr. Eaton of the Gas Light and Coke Company, who has been mainly responsible for the “Fulham” fire. The design of the fire shows that the present standards required have been fully appreciated and met. Although sample grates have been manufactured it will not be possible to go into full scale production until the makers are in a position to change over from war work.

“The case for a big increase in the Society’s income and activities, so well set out in your brochure, seems to me overwhelming.”

—A member, in a letter responding to the Society’s Development Appeal.

HYDRO-ELECTRIC POWER

**A Cantor Lecture by
Sir William Halcrow, M.Inst.C.E.**

Extracts from one of the 1944 Cantor Lectures of the Royal Society of Arts on "The Natural Resources of Great Britain."

MANY people have the impression that water swiftly flowing in a river must be capable of producing large quantities of power. This is not strictly true as, for practical purposes, you must concentrate the water at a point and then make it fall from a height. If you increase the fall of, for instance, a gallon of water from one foot to a hundred feet, you will get a hundred times more power.

Water has been used as a source of power for centuries, the most usual form being the water wheel. The water, collected from a river by building a weir across it, is carried along a channel, often called a mill race, running along the bank. From the end of the channel the water falls on to a wheel which generally drives a mill. The underlying principle is the same even for the largest power station of the present day.

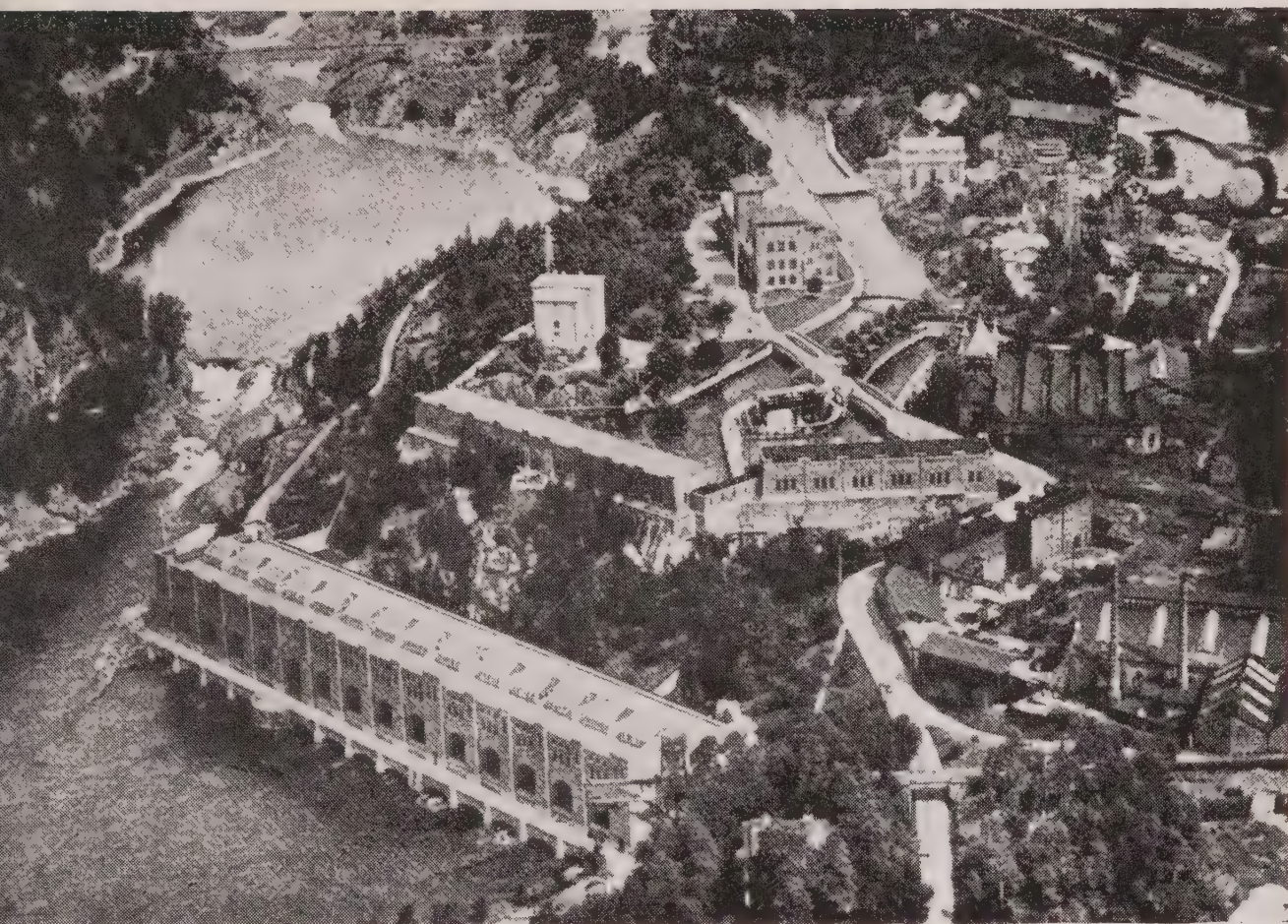
The potential water power resources of Great Britain are not large in relation to the population when compared with other countries, and the areas where major developments have been and can be carried out are mostly far from our industrial towns where the need for cheap electricity is greatest. These towns have grown up round the extensive coal fields with which we are so richly endowed, and electricity has been generated by coal-burning power stations. But, with modern developments in the methods of distributing electricity over long distances, it has become more and more apparent that hydro-electric power can be of advantage to our industries if we produce enough of it.

The production of certain metals, especially aluminium, requires large

quantities of cheap electric power, and it was for this industry that the first hydro-electric power schemes of any size were developed at the turn of the last century. The British Aluminium Company were the pioneers in the production of water power on any scale, and they developed a scheme in 1896 at Foyers, on the shores of Loch Ness. A few years later, the Aluminium Corporation built a power station of about the same size at Dolgarrog in North Wales and by 1914 two more schemes had been developed, still for the production of aluminium, one at Cwm Dyli in the same region as Dolgarrog and the other at Kinlochleven in Scotland. The last one was the first hydro-electric power development to produce a fairly large quantity of power continuously, its capacity being 30,000 h.p. as compared with 6,700 h.p. at Foyers.

It was not until the later period of the Great War that public attention was drawn to the potentialities of the natural water resources of the country by the appointment by the government, through the Board of Trade, of a committee to examine and report upon the water power resources of the United Kingdom and the extent to which they could be made available for industrial purposes. The Committee undertook a comprehensive survey of the question, and in their final report, issued in 1921, stated:—

"The water power resources of Great Britain are to be regarded as of such importance to the Nation that their development should be effectively regulated that they may be utilised to the maximum extent and best advantage."



Acknowledgments to the Institute of Metals

Trolhätton Power Station, Sweden.

Present Development

In 1921 the British Aluminium Company obtained powers by an Act of Parliament to develop the Lochaber Water Power Scheme utilising the extremely high rainfall on the Ben Nevis range of mountains. This scheme was constructed in three successive stages. The power house has a total capacity of 120,000 h.p. and is the largest in the British Isles.

The first of the larger Scottish hydro-electric developments for public supply was carried out in the Clyde Valley in 1926, and in 1927 the Grampian Company began the construction of extensive works, which were completed a few years ago. In the interval three important schemes were put before Parliament in 1929, but two of them, the Affric scheme and the West Highland, were rejected. The third, the Galloway scheme, was authorised and the five power stations were opened in 1935 and 1936.

The Caledonian Power Scheme, which was designed for the production of calcium carbide, formed the subject of Bills in Parliament in 1936, 1937 and 1938, and on each occasion it was rejected on second reading by the House of Commons. In 1941 the second Glen Affric scheme, after being passed by Parliamentary Commission which conducted a lengthy enquiry, was also rejected; so that of the six northern Scottish schemes promoted since 1929, none was passed.

The principal Scottish plants constructed to date are, in the order of size :—

Lochaber
Grampian
Kinlochleven
Galloway
Clyde Valley
Foyers

Schemes planned in some detail but not constructed are the Glen Affric and Caledonian, having capacities which

would bring them between the Lochaber and Grampian plants.

These schemes bring the total developed and projected (to 1941) power in Scotland to about 350,000 h.p. of continuous output.

When hydro-electric schemes were first discussed, it was the general opinion that large quantities of power were going to be made available for the general public at an exceedingly cheap rate, but when certain schemes were put into operation it was found that the price paid for domestic users was just as high as the current in similar areas supplied by steam stations. Hydro-electric power is cheap, but only in its actual production. The distribution of the power costs the same whether it is developed from water or from coal and distribution is by far the largest part of the cost. However, in the case of industrial organisations, where the factories can be established close to the power stations, there is no doubt that they can obtain electricity at a very cheap rate, as has been done for the aluminium industry. An investigation made shortly before the outbreak of war of the comparative cost of power from water in Scotland or from a steam station situated near a coal field showed that under the most favourable conditions, with coal at 15s. per ton, the cost of steam power was about double that of water power. With coal at to-day's prices, the margin in favour of water power is, of course, much greater.

Tidal Power

No picture of hydro-electric development of Great Britain would be complete without reference to tidal power. Tidal power is the power available from the flow and ebb of the tides. The method of harnessing the power is to construct a barrage across an estuary with openings left in it to allow the water to flow into the enclosed area. When the tide is high the openings are closed, and as it falls the difference in the level of the impounded water and the sea below the barrage is utilised to drive turbines.

The earliest record of the use of tidal power is in 1790, when a tidal mill was installed on the River Tamar in Devonshire which was still in operation a few years ago. Originally water wheels were used in tide mills on more

or less the same principle as wheels on ordinary rivers, and it is believed that quite a number of tide mills were in operation at the beginning of the nineteenth century. The Tamar wheel was subsequently superseded by a small turbine.

During the last hundred years several methods of using the power of the tides have been proposed and in some cases utilised. One method was by the float system in which a float of a certain weight was made to rise with the incoming tide, and then allowed to drop during the falling tide. It was made to work through a system of levers and gearing, but the mechanical complications of gearing such a slow motion were too great. A second system was called the tidal stream system, and here it was the flow of the water more than its rise and fall which was made to do the work. A large paddle wheel was made to turn with the current and thence drive the machinery, but here again the power generated was so small that its economic value was negligible. The only workable scheme is the basin system, which I have outlined.

A few years before the war the French constructed a small experimental tidal power scheme on the basin system at Aber Vrach, near Brest. The scheme should prove very interesting when details of its capabilities become available, but from what has been published so far it is evident that there are no insuperable difficulties in harnessing hydro-electric power from tides.

It is clearly desirable to have as large a rise and fall of tide as possible, and favourable conditions are to be found in the Severn Estuary. The maximum rise of tide at the most promising site for a barrage is as much as forty-seven feet, and the estuary above is large enough to store an immense quantity of water.

Severn Barrage

The first proposal for a barrage across the Severn was made in 1849, not with the object of generating electric power, but for impounding the water for shipping purposes, and also with a view to providing a crossing by railway and road to South Wales. Nothing, however, came of this scheme and it was not until 1917 that further consideration appears to have been given to the matter, when a scheme was prepared by my late partner, C. S. Meik,

for a barrage at Beachley, just above the confluence of the Wye, to develop hydro-electric power. The general principles of the scheme were a sluice dam to allow a through passage for the inflowing tide, a turbine dam to generate power on the outgoing tide, locks for ships, and a subsidiary water power scheme with a reservoir at Trelleck Grange for equalising the unequal production of power from the incidence of the tides. The estimated capacity of the plant was 750,000 h.p. The proposal was considered by the Water Power Resources Committee, who agreed that it was practicable and recommended that a further, more detailed, technical enquiry should be made. In 1920 the Ministry of Transport put forward a scheme with the same basic principles, the site chosen being the alternative one at English Stones. In 1925 the Prime Minister appointed a Committee, under the chairmanship of Lt.-Col. J. T. C. Moore-Brabazon (now Lord Brabazon) to enquire into the report on the practicability of the Severn Barrage. A comprehensive study was made of the scheme and the report was not issued until 1933. Recently, the Minister of Fuel and Power has appointed another Committee to review the scheme, in the light of present knowledge, and to report thereon.

The chief difficulty to be overcome in tidal power schemes arises from the continual variation of the power output. The tide falls twice a day and the period of high tide advances by about one hour each day. Again, more power can be produced at spring than at neap tides. To make the tidal power house independent of steam stations, it is necessary to store power when generated and not required for consumption, and to produce it during periods when no power can be obtained from the tides. One method of doing this is, as I have already indicated, to construct a subsidiary water power scheme in the vicinity of the Severn. A reservoir would be formed on high-lying ground as at Trelleck Grange, into which water would be pumped, using power from the barrage, and then drawn from the reservoir to provide power when required. By this system, however, a substantial proportion of the power from the barrage is lost in pumping water to the

reservoir, and it is hoped that the greatly increasing consumption of electricity and the comprehensive system of distribution through a large network of transmission lines (known as the Grid), may lead to a more economical solution of the problem.

On present estimates the power which could be derived from the Severn Barrage would be less than one-tenth of the total consumption of electricity to-day.

An alternative to the water storage subsidiary plant is the use of steam stations, which would have to operate at different periods each day, owing to the advancing times of the tides.

There are other methods of storing power now being considered, and I may mention the studies which are being made of hot water storage. The idea is that surplus energy could be used for heating water in large tanks situated in towns, so that houses could be supplied with constant hot water in the same way as they are supplied with cold water, gas or electricity.

I have endeavoured in this brief lecture to show what possibilities exist for the development of hydro-electric power in Britain. There is no doubt in my mind that great benefits have been enjoyed in Scotland as a result of power developments there, and that these benefits will be extended. Also, the Severn Barrage is being given more immediate consideration, in view of the trend of coal production in the future. Water as opposed to coal is not a wasting asset, and given suitable financial arrangements, the cost of power produced from water should in any scheme be a steadily reducing figure. Present calculations show that Scottish water power, together with the Severn Barrage, could produce about one-fifth of the estimated post-war power consumption in Great Britain.

DISTRICT HEATING—(*Concluded*)

costs include also the cost of unlimited hot water supply. The average fuel expenditure in Scotland is 6s. per week. For an extra 6d. a week at Dundee, Mr. Smith pointed out, the capital costs could have been entirely paid off by now, and in his opinion these results could be improved by 20 or 30 per cent. to-day, with a more modern system.

SMOKE PREVENTION ABSTRACTS

A selection of Abstracts of recent papers and publications of interest. Acknowledgments are made for those taken from indicated Abstract sources.

23. Trail Smelter Arbitral Tribunal (R. S. Dean and R. E. Swain, U.S. Dept. Int., Bur. Mines Bull., 453, 1944). Damage to vegetation in parts of Washington State by smelters at Trail, British Columbia, has caused much international litigation. A joint Canadian-U.S.A. Arbitral Tribunal was set up in 1935 to attempt to prevent future damage and has made studies, now reported, of atmospheric conditions in the area. At Trail the SO_2 emission can be varied by using it at will in absorption units for by-product manufacture. This feature makes possible the use of meteorological criteria in so governing the output of SO_2 as to avoid damage to vegetation. The report discusses the relationship between meteorological conditions in the valley and atmospheric diffusion processes. From the general distribution of the gas and mean wind conditions the transport of the gas under average conditions can be seen. Turbulence is the main cause of diffusion and its relationship with lapse rate and wind velocity is indicated. The report gives provisional and final operating régimes in force.

24. Atmospheric Pollution (A. G. G. Leonard, J. Proc. R. Inst. Chem., 1943, 110. Chem. Abstr., 1944, **38**, 3047). Suspended solids are determined by filtering the air through filter paper and comparing the darkness with carefully prepared standards. In Belfast the pollution by domestic fires was 2.3 and 3.3 times that due to industrial fires in summer and winter, respectively, as compared with about 2.5 and 3.5 times for Great Britain. The average daily pollution is 2.4 times as great in winter as in summer. Loss of daylight was determined by titrating the iodine liberated from acidified potassium iodide in small bottles placed in the city and surrounding country. Daily titrations with thiosulphate showed that in Dublin in the winter of 1939-40 45 per cent. of the daylight was lost to the city.

25. Carbon Monoxide Poisoning (C. Pharris, Conn. Ind., 1943, **21** (10), 12, 32. Chem. Abstr., 1944, **38**, 3364).

The diagnosis of carbon monoxide poisoning, detection of carbon monoxide, industrial and non-industrial sources and the nature of carbon monoxide poisoning are discussed.

26. The Underground Gasification of Coal (E. T. Wilkins, Fuel Econ. Review, F.B.I., **23**, 1944). The development of underground gasification of coal in Russia is outlined and three different methods described. Of the two most attractive methods one appears to be applicable only to steeply dipping seams, and the other to require coal properties not found in all British coals. The methods so far tried in Russia may not be suitable for application to coal seams now being mined by conventional methods, but it may be that they can be applied to certain seams which now present difficulty in working. This conclusion conforms to the Russian precedent, for in that country experiments appear to have been confined to seams which present some difficulty in mining for various reasons, including (i) thinness of seam, (ii) excessive angle of dip, (iii) underground fire hazard, (iv) high ash content of coal. There are known difficulties in operation, such as that of maintaining a regular supply of gas; and information on a number of points is lacking. Until more information is available, the potentialities of the process in this country cannot be accurately assessed.

27. The Harmful Effect of Combustion Gases from Industrial Furnaces on Vineyards (O. T. Koritnig, Weinland, 1943, **14**, 138. Chem. Zbl., 1943, (I), 1625). The harmful effects of sulphur trioxide, soot, flue gases and coke dust, water vapour, carbon monoxide, hydrogen sulphide and tar and of their mixtures are discussed. The greatest harm to cultivated plants was caused by sulphur trioxide and soot.

28. The Mysteries of Dust (K. N. Bagchi, Sci. & Culture, 1944, **9**, 346). The sources and harmful physiological effects of industrial dusts are discussed. Dust, it is claimed, may be regarded as an index of industrialization and comparative figures are quoted.



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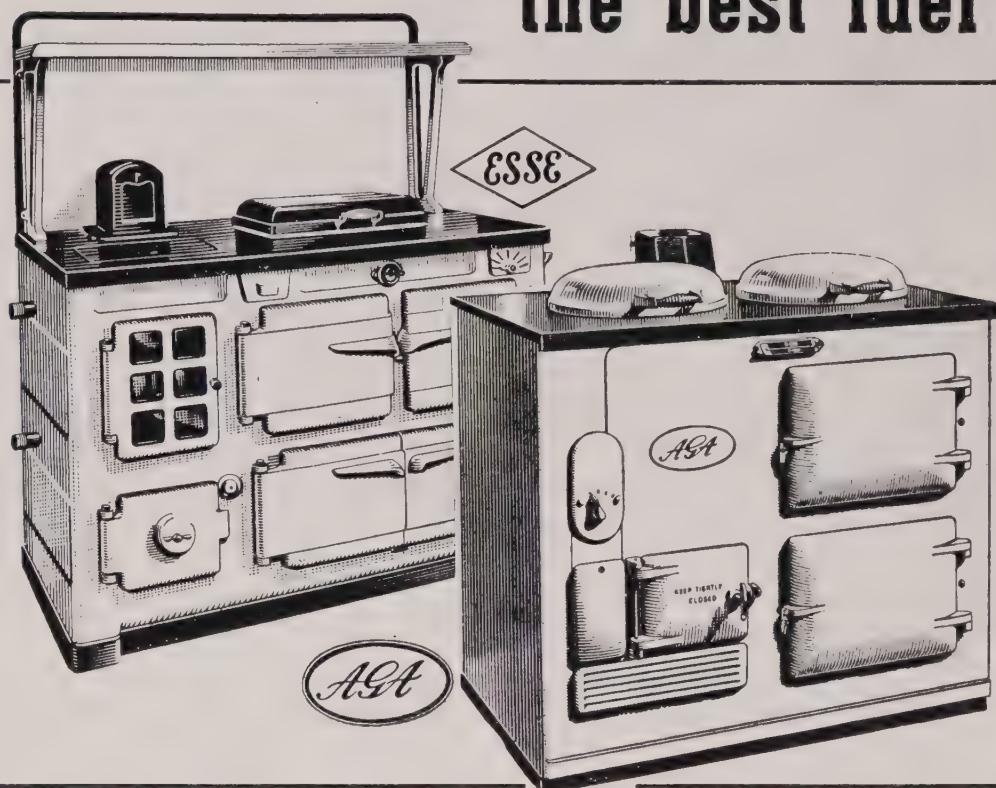
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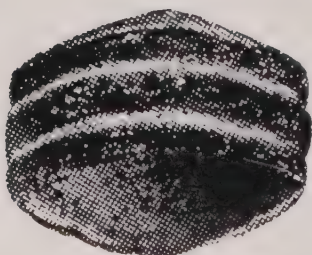
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SMOKELESS AIR

Reconstruction Within

OF the recent joint conference with the Institute of Fuel, which was in every way a very successful event, we need only say that the full report of the proceedings is now ready. It includes the opening address by Mr. Tom Smith, M.P., Parliamentary Under-Secretary to the Ministry of Fuel, all the papers and the discussion. The report is an up-to-date survey of the principal aspects of the problem, and runs to about forty thousand words. The price is 2s. 6d. per copy, post free. The Institute's appreciation of the conference is reflected in a decision that its regional

sections should each year arrange a joint meeting with the Society for the discussion of technical questions. The conference naturally overshadowed the Society's annual general meeting on the previous day, but the results of this are likely to be far-reaching. It was a lively, outspoken meeting, with a marked sense of urgency about pressing forward with our work, and critical of the Society's present organisation. Its main decision was to instruct the Executive Committee to draft a new constitution for submission as soon as possible to a special general meeting.

What has happened, of course, is that the Society has developed, and is continuing to develop, in a way that makes its 1929 constitution increasingly unsatisfactory. The Executive is now working on a draft of a new constitution, and members will before long be receiving a copy of this together with a notice of the special meeting at which its adoption will be proposed.

The Main Proposals

It is likely that a higher scale of subscriptions, designed to secure a better income for the Society, will be proposed. This will not apply to individuals but will concern Local Authority and Corporate members, whose approval will have to be secured. It will also be proposed that the present unwieldy Council, and the Executive Committee, should be replaced by a new Executive Council of thirty members, to be elected by postal ballot, and that the Society should be divided into geographical Divisions, the members of which would elect to the Executive Council representatives proportionate in number to the relative strength of the Division. There are also other interesting proposals for change.

The Questionnaire

From the replies and correspondence arising from the questionnaire recently sent to members it is evident that they like to be consulted about matters of the kind raised. It was not, of course, a vote. A decision about a new name for the Society, for example, can only be made at a General Meeting, but the replies are a very useful guide to the opinion of members. As an interim report—for the forms are still coming back—out of 330 replies, 59 per cent. wish the Society to change its name and 35 per cent. desire no change. 73 per cent. think that the word "National" should be retained in any case. If there is a new name, 34 per cent. prefer "Smoke Prevention," 25 per cent. "Smokeless Air," and 11 per cent. "Smoke Abolition" Society. Individual suggestions included "Pure Air," "Cleaner Air," and "Chimney Smoke Abatement" Society.

With respect to changes in *Smokeless Air*, 59 per cent. like the present pocket-size and 34 per cent. want us to revert to

the large pre-war size of page. 90 per cent. like illustrations and the glossy paper that is necessary for the good reproduction of photographs, and two-thirds of these would like still more photographs. The replies to the question of whether the journal should be more technical or more popular are interesting. 26 per cent. would like it to be more technically informative, 36 per cent. want it more popular, while 35 per cent. consider that the contents should remain about the same. This is gratifying in showing that we have managed to balance the very varied interests of our readers with some success. The percentages do not add up to 100 in any case, it will be noticed, and this is because a number of the forms were not completed in every item. Quite a few have still to be returned, in spite of the stamp so thoughtfully provided!

The Case of the Pint Pot

Until there is more paper available few changes can be made in *Smokeless Air*. More and more material we should like to use—*ought*, in fact, to use—is squeezed out, and the reader, who sees only what is published, cannot appreciate what has to be put on one side. In this number we should like to have given a full report of the recent conference of the Scottish Branch in Glasgow, of the first meeting since 1939 of the Bristol and District Regional Committee, some substantial parts of an important paper by Dr. G. E. Foxwell on the future of coal carbonization, illustrated accounts of at least two important new developments for post-war heating in the home, extracts from a paper on coal read at the conference of the Association of Scientific Workers, a full account of one of the B.B.C.'s "To Set You Talking" broadcasts, in which smoke prevention had an important bearing—and much more, without mentioning articles on less topical matters that would help to develop the Society's case. It is a problem due to rationing that is far more exasperating than that of spreading out the points and the clothing coupons.

Smoke Around Sheffield

The Minister of Fuel and Power's reference to Sheffield's smoke and its

consequences to the moors around the city, made in the debate reported on another page, has caused great alarm and despondency in that city. The Chamber of Commerce is reported to have written to Major Lloyd George, saying "People who have lived here all their lives cannot recollect a single occasion when there have been conditions on the moors you are alleged to have described. . . . The suggestion that smoke spreads to the moors is resented." Of this, all that can be said is that if Sheffield's smoke does *not* spread to the moors, it is the most remarkable smoke yet emitted into the air of this country. London's smoke has been observed out across the Channel and over northern France. Lancashire's smoke reaches the Isle of Man. English smoke drifts have been observed 350 miles away on the west coast of Eire—and yet Sheffield is stoked that its smoke should even stray to a dozen miles or so from the city limits! It is unusual for the business men of Sheffield to be so touchy about their smoke. Can it be that there is a growing appreciation of the fact that, apart from everything else, it is the worst civic advertisement imaginable?

Another Point of View

Those concerned with the amenities of Sheffield and its neighbourhood are more aware of the smoke evil than this. The Sheffield and Peak District Branch of the Council for the Preservation of Rural England have published an attractive and forceful illustrated booklet on "Sheffield's Green Belt." On the first page we find a photograph of smoke, and a paragraph headed "Sheffield's First Enemy: Smoke." "Smoke dirt," it says, "discharged by failure to burn coal correctly, is deposited in our industrial region at the

rate of 500 tons to the square mile every year. It robs us of sunlight, injures health and blackens and degrades the city. It prevents healthy residential development within its inner area and forces 'sprawl'—wasteful building on the outer borders—which destroys valuable milk farms and rural amenities. Until this prime evil is overcome by newer scientific methods, Sheffield can never be wholly healthy or beautiful."

Atmospheric Pollution

The Department of Scientific and Industrial Research has issued a brief summary report of Observations on the Investigation of Atmospheric Pollution for the year ended 31st March, 1944. It shows that the number of instruments in use by the Co-operating Bodies has been fairly well maintained. On the results of observations the report says: "The winter of 1942-43 saw the beginning of an increased national effort towards fuel economy, and it was shown in last year's summary report that during that winter there was a significant reduction, for the country as a whole, in both deposited matter (including sulphates) and sulphur dioxide. The reduction of sulphates in deposited matter was maintained for the whole of the year ended 31st March, 1944, and after allowance had been made for the probable effect of differences in rainfall, the rate of emission of sulphates in 1943-44 was estimated to have been about 7 per cent. less than in 1941-42. Other forms of deposited matter were not significantly lower in 1943-44 than in 1941-42."

The report includes notes on rapid surveys, and on other instruments, including the new "smoke filter," which is a method much simpler than the automatic filter for measuring the daily mean concentration of smoke suspended in the atmosphere.

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COAL IN RELATION TO ATMOSPHERIC POLLUTION

A Lecture by Dr. A. Parker

A CHADWICK Public Lecture, with the above title, was delivered at the London School of Hygiene on 13th March, 1945, by Dr. A. Parker, Director of Fuel Research Department of Scientific and Industrial Research. Dr. Parker reviewed the historical aspects of the smoke problem and then considered the quantity of coal used in relation to population. He showed that the important changes in Great Britain during the last 140 years have included "an enormous increase in the annual output of coal from roughly 10 million tons to about 200 million tons, and a great increase in the population from roughly 10 to 45 millions, and the crowding of masses of people in large towns. Most of the coal brought to the surface in Great Britain is used in this country. If there had not

been considerable improvements in the methods of using coal, atmospheric pollution from this source would certainly have been very much worse than it is to-day. This does not mean that conditions are anywhere near satisfactory. They are definitely not satisfactory, and vast improvements have yet to be made if the amount of pollution is to be reduced to the stage at which it could be described as negligible."

The paper then discussed the question of efficiency in the use of coal, and the composition of coal and the products of combustion, together with the nature and amount of pollution. A table was given in which the pollution from different types and uses of fuel is analysed, as follows :

Nature and Quantity of Pollution from Coal in Great Britain

	<i>Quantity of Coal</i> <i>(millions of tons</i> <i>per annum)</i>			<i>Pollution produced</i> <i>(millions of tons</i> <i>per annum)</i>		
				<i>Smoke</i>	<i>Ash</i>	<i>Sulphur Dioxide</i>
Coal						
Domestic grates	42	1.1	0.1	1.0
Electricity power stations	14	small	0.1	0.4
Railways	13	0.4	0.1	0.4
Collieries and various industrial uses	68	0.8	0.2	2.4
Coke and Gas						
Coke ovens and use of coke	20	small	small	0.5
Gas industry at gasworks	19	small	small	0.1
in using gas	—	nil	nil	small
in using coke	—	nil	small	0.2
Total	176	2.3	0.5	5.0

“From the figures in this table,” continued Dr. Parker, “the weight of tarry and carbonaceous matter in the smoke produced is between 2 and $2\frac{1}{2}$ million tons a year, or roughly $1\frac{1}{4}$ per cent. of the weight of the coal used. Approximately one-half of this weight of smoke is derived from domestic grates, which use only about one-quarter of the coal. The total pollution by oxides of sulphur is about 5 million tons a year, and the weight of the grit or ash discharged into the atmosphere is roughly 0.5 million tons. Not more than one-fifth of the sulphur and grit arises from domestic appliances burning raw coal.”

The Cleaning of Coal

“It is practicable to effect a considerable reduction in the amount of the pollution caused by smoke and grit, though it is much more difficult to reduce the amount of pollution from sulphurous gases. How can such an improvement be effected? There is no one method. Developments and changes in several directions are necessary.

“In the first place, all practicable steps must be taken at the colliery to clean the coal before delivery to the consumer, whether the coal is to be burned direct or used for the production of coke and gas. By efficient cleaning, much of the foreign matter, including shale and pyrites, unavoidably brought with the coal from below ground to the surface can be removed. In this way the quantity of mineral matter and sulphur in the coal as supplied can be reduced. A reduction in the mineral matter will reduce the quantity of ash and dirt to be removed when the coal is burned, and it will reduce the amount of ash in coke made from the coal; it may also reduce the quantity of fine particles of solid matter carried forward with the chimney gases to the atmosphere, though this is not always the case. Removal of pyrites reduces the proportion of sulphur and effects a corresponding reduction in the quantity of sulphurous gases discharged into the chimney. Methods of cleaning coal are being improved and their use at collieries has been extending steadily. At the same time it should be pointed out that as the best seams of coal are gradually worked out, seams of poorer quality have to be mined,

thus increasing the difficulty of producing coal with very little ash. With the poorer coal, there is clearly greater need for efficient cleaning at the colliery.”

An Important Development

Dr. Parker referred to a development about which full details have not yet been released. He said: “It has not been possible in the past, with the large numbers of hand-fired boilers at numerous industrial works to avoid the emission of smoke, particularly for a time after stoking. As a result of extensive work by the Fuel Research Station during the last few years, equipment has been developed to replace the doors of marine and Lancashire boilers, whereby the emission of smoke can be practically eliminated. The equipment is simple to construct and very simple to operate. It provides at the right time and in the right way, the extra air required to burn the smoky volatile matter evolved from the fresh coal for the necessary period after stoking. This equipment is already in satisfactory use on many hundreds of marine boilers, and its value has been fully demonstrated; not only does it greatly reduce the amount of smoke, but it assists in maintaining high efficiency in utilising the heat value of the coal.”

The Domestic Fire

“The domestic open fire produces more smoke per ton of coal burned than any other appliance in general use; it has already been mentioned that about one-half of the smoke pollution arises from domestic appliances, though they consume less than one-quarter of the total coal used, or less than one-third of the coal burnt direct and not submitted to such processes as carbonisation. Though the problem has been studied by many investigators, there is no immediate prospect of designing an open fire, which will burn bituminous coal without producing any smoke. There are designs of open fire, however, which will bring about a reduction in the amount of smoke to about one-half of that with the open fire of the usual type, but they have not yet been tried out in general use by the average household. The emission of smoke during the early stages of burning up after lighting seems to be unavoidable.

With open fire grates of suitable design there is no difficulty in satisfactorily burning coke, provided that the coke is in pieces of suitable size. Closed stoves and so-called openable stoves use the fuel more efficiently than open fires; they are excellent with coke and with anthracite but are not entirely satisfactory with bituminous coal. If more coke was available and was used in domestic appliances in place of coal, there would obviously be a great reduction in the amount of smoke pollution.

"There is at present no method of reducing the amount of pollution by sulphurous gases from each ton of solid fuel burnt in domestic appliances, whether the fuel used is coal or coke; the proportion of sulphur in coke is roughly the same as in the coal from which it is made.

"Pollution by grit from the burning of coal and coke in domestic appliances is not easily prevented, though fortunately it is not very great. Substitution of gas for solid fuel would avoid pollution by smoke and grit and would reduce pollution by sulphurous gases to a negligible amount. The use of electricity in place of solid fuel avoids the production of smoke, but would not prevent pollution by grit and sulphurous gases unless the generating stations are equipped to remove the grit and sulphur from the chimney gases.

"So far as domestic appliances are concerned it would seem that encouragement should be given to the use of coke, gas, and electricity in place of coal, so far as is economically practicable, if atmospheric pollution is to be greatly reduced."

SMOKE PREVENTION AND THE MINISTRY OF FUEL

House of Commons Debate

IN the debate on the Ministry of Fuel, and Power Bill, by which the continuation of the Ministry after the war is assured, an amendment was moved by **Major S. F. Markham** (Nottingham South) which would include in the functions of the Minister "the abatement of smoke and other nuisances arising from the consumption of fuel or utilisation of power." Major Markham pointed out that there were four departments of the Government interested in the question—the Ministry of Health, under the Act of 1936, the Department of the Lord President of the Council responsible for scientific research, the Air Ministry, "extremely interested in all measures dealing with the purity of the air," and finally the Ministry of Fuel, "as being interested in the origin of all these nuisances." The question was which was the best method of ensuring that rapid steps were taken to abate the smoke nuisance.

"I think it is generally known to every hon. Member of the Committee,"

said Major Markham, "that our great cities lose one-third of their sunshine through the unnecessary smoke produced domestically and by factories. A loss of sunshine in its turn, creates illness and disease, which lay a very heavy toll on the nation. I do not think there is anyone who will disagree with me when I say that probably the greatest boon that could be given to the people of this country would be the boon of clear skies. In the past the Ministry of Health has certainly been interested in this matter, but not very forcefully. Under the Act of 1936 they carried out their duty by methods of persuasion and not by compulsion, and I think it is true to say that in general, over the last nine years, persuasion has failed."

Major Markham went on to give as an example of nuisance the consequences of a red lead factory in a Northamptonshire village, and referred to what had been done about slag heaps, which "before the war were great smouldering

conflagrations.”

“Time after time local people interested in this question came out with proposals that these slag heaps should be doused and the fog of smoke stopped, but they were told nothing could be done. When the war came along and it becomes necessary to put these slag heaps out, it was done within a very short time. That is a very good example of how powers of persuasion fail and how there must be powers of compulsion to deal with a public nuisance.”

The Minister, suggested Major Markham, was responsible for the fuel and for the apparatus which either creates or dissipates this air pollution. “If we are to stop the trouble, as I hope it will be stopped, in a short time, it must be stopped at the source, and the only way to stop it at the source is for the Minister of Fuel to have power to control the apparatus that is put into both houses and industry, and in selecting and, indeed, compelling, the use of the best fuels for all occasions.”

“The time has come for a single Department to be responsible, root, stock and branch, and for making sure that there is some progress.”

Mr. J. H. Wootton-Davies (Heywood) supported Major Markham. Smoke, in the opinion of many people, was one of the most serious disadvantages under which we in this country lived. He quoted the case of Port Sunlight, which burnt something like 5,000 tons of fuel a week, and there was never a waft of smoke coming from the stacks.

Mr. Emmanuel Shinwell (Seaham) thought the Minister might have difficulty in accepting the precise wording of the Amendment, but hoped he would at least give a sympathetic reply. “There is general agreement,” he said, “in this matter. It could not be otherwise. Anybody who has examined the problem, and many who have not examined it are only too acutely aware of the obnoxious smells, the pall of smoke that overhangs our great cities, and even our villages and small townships; and of other objectionable features that have emerged from the wrong utilisation of coal. That is the fundamental problem.”

“I venture the opinion that if we had conserved our coal resources effectively

before the war, and used coal efficiently and scientifically, we might have had no coal problem at all during the war, many of our Debates would have been unnecessary, my right hon. and gallant Friend would have been spared a good many headaches, and indeed, the question of setting up a Ministry of Fuel and Power might not have arisen.”

“I am going to be quite blunt with the Committee on this matter. For many years it has been my view, and I even met with a certain amount of opposition among people in mining areas who are so accustomed to burning coal in its raw state that, if I had the power myself—I mean real power, the sort of dictatorial power one would like to assume on certain occasions in order to get something done—I would have prevented the burning of coal in its raw state in this country. Some people like it. I think it is an abomination, and, in the long run, from the stand point of health and of fuel conservation, it would be one of the finest reforms in which this country had ever engaged if we could prevent the burning of coal in its raw state.

“Some liaison between the Ministry of Health and the Ministry of Fuel and Power appears to be essential, but, in any event, what we want from the right hon. and gallant Gentleman is an assurance that this matter is being earnestly tackled, and that he will not be handicapped by sentiment or old-fashioned ideas or traditions about the burning of fuel but will face this matter, and that in due course schemes will emerge which will promote better health for the people of this country, and assist industry to conserve its resources and make headway because we are not wasting our resources. That is the essential point. We should not waste our resources but use them efficiently.”

Mr. S. B. Hynd (Sheffield, Attercliffe) said he represented a constituency which has the heaviest soot fall in the whole of Great Britain—where not only was there hardly a blade of grass to be seen but in practically every household there was someone suffering directly or indirectly as a result of the bad atmosphere in which they had to live, due to the smoke from the chimneys of the big steelworks and factories.

He asked: “Why is all this necessary? There is already general agree-

ment amongst all sections in this House that the smoke nuisance is a curse to the country, and should be tackled very effectively. I have never yet seen a satisfactory answer to the question of why the smoke nuisance continues, and has continued for such a long period, in view of the fact that most countries in Europe, even industrial countries, are not effected by this nuisance to the same extent. They find ways and means of overcoming it. And it is not beyond the powers of British science and research and of the British fuel and power industry to find ways and means of overcoming the trouble in this country. . . ."

"I have been told on pretty good authority that before the war, the coal-owners in this country spent many thousands of pounds on publicity, in order to discourage the effective economic use of coal and its by-products and to encourage an increased turnover from the sale of raw coal from the pits in this country."

Major Lloyd George, replying, said that he could confirm Mr. Hynd's remarks about the worst pollution in the country. "I remember some years ago being on the moors miles away and very high up on a beautiful summer's day, and, in a very short period, it became almost night and I found that even the heather was practically covered with soot. I do not think there is really anybody in this country who would be other than sympathetic to this objective."

The Minister did not, however, think it really necessary to put such a clause in to the Bill. The Minister of Health had certain powers and he kept in the very closest touch with him. In the Bill the Minister was charged with "the duty of promoting economy and efficiency." While it was not a hundred per cent. true to say that once you eliminate smoke, you have eliminated nuisance from combustion, "the basis of most of the nuisance is the wrong utilisation of fuel."

"The Chairman of a meeting of the National Smoke Abatement Society only the other day paid a very generous tribute indeed to the work that this Ministry had done in regard to smoke abatement."

The policy of the Government, continued Major Lloyd George, was as stated in the Housing Manual, from

which he quoted the passage which includes the statement that "the Government attach particular importance to smoke abatement in view of the injury to health and to general amenities caused by atmospheric pollution."

"That is the policy which the Government intend to pursue," continued the Minister. "It is being pursued as far as is possible under the limitations of war but I can assure my hon. and gallant Friend of this. I have visited research centres and a tremendous amount of their work is concerned with this question of the right use of fuel in order to reduce the smoke nuisance as much as possible." The research work would go on. He assured Major Markham that the words "economy and efficiency in the use" in the Bill would cover the question of smoke as far as any Minister of Fuel and Power was concerned, and that as this was a machinery Bill which charged him with general duties, and that if he wanted any powers as was suggested he would be able to get them from the House. He hoped, therefore, the Amendment would be withdrawn.

Mr. O. Lewis (Colchester) suggested that the Minister should have a word with the Minister of Health and see whether some words placing some such obligation on the Minister of Fuel and Power might not be inserted in the Bill in another place.

Major Markham withdrew the Amendment but before doing so said: "I am still not satisfied that the Minister now, or under this Bill, has power to make a single factory in this country adopt smoke-abating appliances. He has not got it, the Ministry of Health possibly have it under the 1936 Act but they do not proceed under that Act. I know the Minister is well intentioned but what we want to see are definite results."

Major Lloyd George: "May I make it plain that, even if these words were in the Bill, they would not give me the power to do anything. Whatever I have to do, whether it be on coal or electricity, this simply gives me the general line of duties which a Minister would have to pursue. Whatever new measure I propose, whether gas, electricity or coal, I would have to present to this House."

The full report appears in *Hansard*, Vol. 409, No. 50, 16th March, 1945.



*More petrol means more
cars on the road and more—*

CARBON MONOXIDE

By W. L. Fisher, M.I.A.E.*

EVERYONE with a vestige of social conscience must be outraged at the state of the air in our big cities. Over hundreds of square miles, and for long periods, human beings live under a blanket of fog. Oxygen and the life-giving sun are excluded, and to this shocking human wastage, is allied the wastage of fuel resources. All these products of combustion are harmful to health and property, but the purpose of these notes is to draw attention to a still more dangerous phase of atmospheric pollution. This goes on continuously owing to the widespread and growing use of motor

vehicles and is a comparatively recent development. It has nevertheless largely undone the good work that the Smoke Abatement Society has done in other directions. Although we no longer get the old "pea-souper" fogs nowadays, we perpetually inhale another far more lethal poison in the form of carbon monoxide.

The fact that the overall percentages of this gas are low does not help very greatly, because even traces are deleterious to health, the effects being cumulative. Inhalation over a period gradually and progressively kills the white blood corpuscles. To restore the blood to normal, the dead corpuscles have to be eliminated and replaced by

* Editor of "The Automobile Engineer."

new growth. This takes time, and one per cent. of the gas if continuously inhaled will destroy these corpuscles faster than they can be renewed.

It is evident therefore that while fogs are intermittent and transitory, carbon monoxide has become with other forms of pollution a permanent feature of the atmosphere in towns. There is little doubt that much of the lassitude, debility and headache that afflicts town dwellers is due as much to poison inhaled as to loss of sunlight. Moreover, a night or day in fresh air will not counteract these effects. Medical men say that a period of three weeks to a month at least is necessary to correct any appreciable state of carbon monoxide poisoning.

What is then to be done? Obviously if we really mean to clean up our cities we must either exclude the petrol-driven motor vehicle or make these burn their fuel completely. The diesel though "smelly" is a non-offender in the matter of carbon monoxide, but at present it is only practicable in vehicles of the larger sizes. The trolley bus and the electric vehicle are really the ideal road vehicles in towns, but it is hardly likely that petrol vehicles will be excluded from town centres altogether.

Some check may, however, be enforced upon us if only to reduce traffic congestion. On this account car owners may at some future date be compelled to abandon their vehicles outside a two or three mile radius and take to the public transport services. Already in pre-war days, traffic was becoming gradually immobilised by the very numbers of the vehicles using the streets.

Reverting, however, to the matter of pollution, the problem basically is one of incomplete combustion, and the solution is therefore a job for our engineers. The petrol-driven vehicle *can* be made perfectly innocuous if the will to see this job through exists. It is simply a matter of so devising the carburation system that the fuel is *at all times completely* burned. This *has* been achieved and some such system could be universally applied at little, if any, increase in the first cost of the vehicle.

Were some such method generally adopted, very considerable fuel savings would be incidentally effected. At the

moment, the fuel is never completely burned and the more faulty the combustion the greater the percentage of CO in the exhaust fumes. It is estimated that not less than 10 per cent. of our fuel importation into this country is at present utterly wasted in this way. This wastage is unnecessary and avoidable, and it is in fact this 10 per cent. that we now employ to poison the population.

The automobile engineer's approach to his various problems is naturally largely governed by public demand. Until there is general sensitiveness to, and revolt against, the danger and discomfort of the existing state of affairs, nothing will be done. For one thing, it is easier for the designer to waste fuel rather than design scientifically. Indeed, in many instances designers have no understanding of the first principles involved. In other words, they are mechanics, not chemists or physicists. Also they are under no pressure to find ways of avoiding atmospheric pollution by carbon monoxide. The law compels them to design for a clear exhaust free of oil fume, which incidentally is quite harmless, but there is no such obligation to check the outflow of lethal products. Nevertheless, given a knowledge of the underlying principles and chemical laws, it is quite possible to design for complete CO elimination, and it is high time this were enforced by legislation.

Sir Napier Shaw

It is with regret that we record the death of one of our most distinguished Vice-Presidents, Sir Napier Shaw, F.R.S. Sir Napier, who was born in 1854, was a great meteorologist, and had a close and lasting interest in the problem of smoke. He was joint author with Dr. J. S. Owens of "The Smoke Problem of Great Cities," and as Director of the Meteorological Office was closely associated with the development, from its earliest days, of the Investigation of Atmospheric Pollution. For many years he was Chairman of the Committee of this body, and he was also President of the Smoke Abatement league of Great Britain until it became a part of the present Society. Sir Napier had many honours and distinctions in the academic field and in the realm of international science.

Air Pollution Survey in Bilston

**An account, by G. Eric S. Sheldon, M.R.San.I.,
M.S.I.A., of how, in a short period of time, the
Midlands town of Bilston estimated and mapped
the extent and nature of its smoke problem**

IN Bilston as in all other progressive towns, it is envisaged that considerable activity in the execution of prepared plans for reconstruction and housing development will be an immediate post-war necessity.

In view of the need of being equipped with complete information to assist in this work, certain officers were called together by the Town Clerk to investigate the possibility of holding a Civic Survey. It was agreed that such a survey was timely and expedient, and it was decided that the work should proceed with all speed.

A scheme was prepared, submitted to the Borough Council and approved, and the various officers were delegated to their appropriate avenues of investigation and research. A tentative period of nine months was fixed for the completion of the survey.

Some Authorities had already completed a survey, but after reviewing their efforts, it was found that little or nothing had been recorded with reference to atmospheric pollution, and it was considered essential that a relatively true picture of the problem in Bilston, which is undoubtedly a black spot in this direction, be obtained if possible. It was felt that the results would enhance the findings of the other avenues of enquiry, and in all probability provide an additional link in the chain of evidence and information to enable the borough to formulate a plan which would benefit to the full both industrialist and town-dweller alike.

Bilston is an integral part of that much maligned area known as the Black Country. Industry is an essential part of its being, and it is obvious that plans for re-development could never hope to convert it into a garden city. At the same time the obvious pollution of the atmosphere by industrial and domestic chimneys demands re-zoning and re-development on certain lines, and the pollution survey was intended to

assist in this.

The set period of nine months in which to complete the work was a severe handicap. It is well recognised that research covering a period of years is necessary to provide a true picture. However, an approach was made to the Department of Scientific and Industrial Research, and at once it was found that wholehearted co-operation and interest were forthcoming. An interview with Dr. Meetham, Superintendent of Observations, led to the evolution of a plan of campaign. The memorandum on Rapid Surveys had not then been issued. The general idea was to give, in the limited time available, as complete information as possible as to the extent of the nuisance from deposits, smoke and acids.

The Methods Used

It was realised that for deposits, the recognised form of measurement, the standard deposit gauge, was out of the question unless a sufficient number could be provided to give relatively close recordings over the whole borough. The cost involved and the inability to acquire such at that time negated the idea. The cost, to a small borough such as Bilston, would have borne no relation to the results obtained.

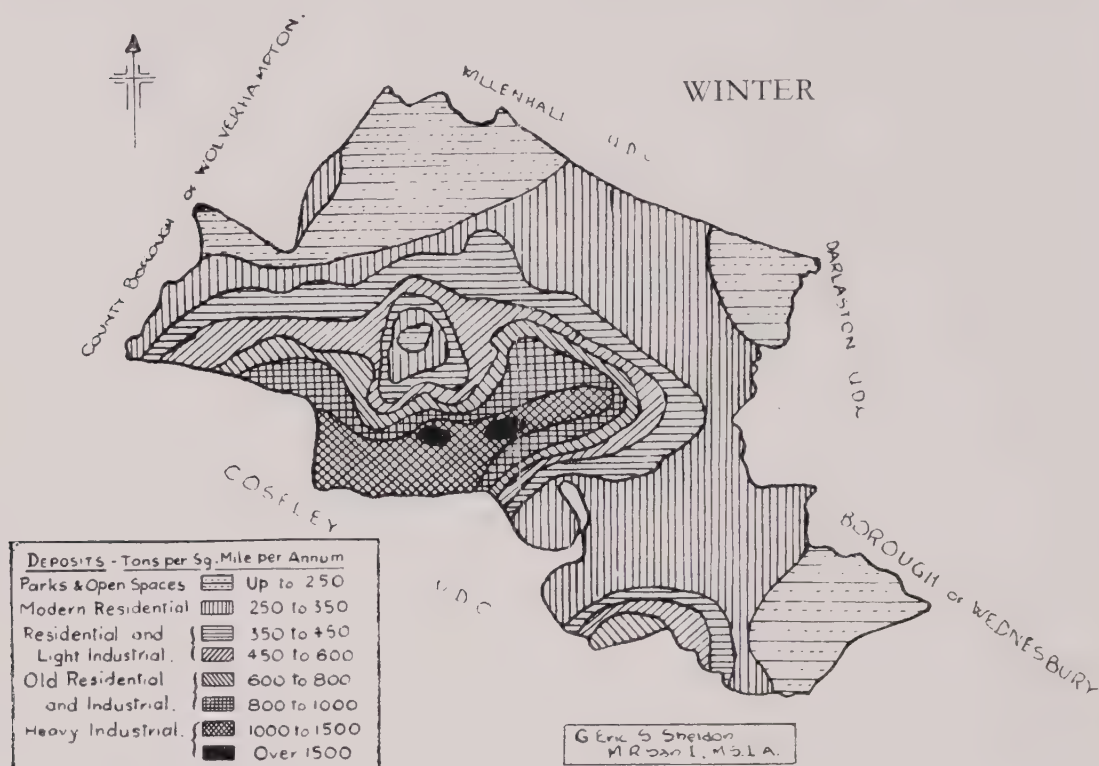
After lengthy deliberations, the idea of using petri dishes was born, but at the same time it was realised that there were many factors governing their successful use. The idea was considered to be worthy of a trial, however.

It was also decided to commence daily readings of SO₂ concentrations, and incorporate a smoke filter in the standard volumetric recorder for the purpose of measuring the amount of suspended matter in the air.

To obtain more complete information as to SO₂ concentrations, it was decided to use the standard lead peroxide gauge in sufficient numbers to give recordings at half mile distances.

BOROUGH OF BILSTON

Estimation of Deposited Matter by Petri Dish Method



A scale plan of the borough was used and predetermined sites for petri dishes were plotted every 440 yards over the whole area. With this selection of sites it was then necessary to visit each to decide the most suitable position for each dish. Many factors had to be taken into consideration, e.g. nearness of over-hanging structures, trees, and freak pollutions; height above ground level; surface upon which the dish would rest; risk of interference, etc.; but after a careful survey it was possible to find the 40 sites necessary for the experiment.

The volumetric recorder, after some delay, was assembled in a convenient room at the office, and with the assistance of Dr. Meetham it was possible to obtain various essential components difficult to acquire.

Thirteen lead peroxide gauges were necessary to give the required recordings at distances of half a mile, and the selection of sites for these was even more difficult than for the petri dishes. The solution was the use of private gardens of reliable householders; the gardens of public buildings, and on the

roof of the fire station tower. This latter site was considered particularly necessary because the station is surrounded by a poor type working class dwelling, a count of the chimneys of which gave the figure of 95 in an area of little over 100 square yards.

Further difficulties were overcome in obtaining the gauges. The wooden stands were made by converting disused A.R.P. direction indicators. Zinc cowls were unobtainable, so galvanised ones were used with success. The greatest obstacle was the provision of the porcelain candles. These were impossible to obtain, but the local works of the Phoenix Glass Company finally gave the solution. They manufactured a sufficient number of plain heat-resisting glass candles without the recess. Tests were made as to their reaction to SO_2 , but they were found to be negative. A local engineering works produced the necessary brass spindles. An airtight box was also made for transporting the candles, and it was found most satisfactory to have spring clips inside into which the candles were placed and tightly held to prevent movement.

The necessary analysis and weighings were made possible through the courtesy of the managing director and directors of Messrs. Stewarts and Lloyds, whose steelworks are partly within the borough boundaries. A keen interest was displayed in the research to be undertaken, and the services of their chief chemist and his staff were made available voluntarily.

The Petri Dish Records

The intricate part of the survey was the experiment with the petri dishes. The deciding factor in the success of such was largely dependent upon favourable weather. 'Heavy rain or strong wind rendered an observation void. A careful watch of barometric pressures and a study of the Beaufort wind scale, as given in the Meteorological Observers' Handbook, together with good fortune, enabled three successful observations to be made with four attempts. These were made in December, 1943, April and July, 1944, and on each occasion the weather held favourable for the two-day period of exposure.

It was found possible to site the dishes or to collect them with the use of a car and an assistant in approximately $2\frac{1}{2}$ hours. Each dish was polished, numbered for reference, and the covers were only removed during the period of exposure.

After successful exposure, the dishes were deposited with the chief chemist who undertook the weighings of the deposits with an Oertling Balance No. 5 S.B. to an accuracy of one-tenth of a milligram. A factor for converting one milligram of deposit in a dish into English tons per square mile was calculated, and applied to each weighing. The result gave a series of weights in tons per square mile per annum.

After various experiments it was found that if these weights and the sites were plotted upon a plan of the borough, it was possible to create contours by joining the weights, within determined limits, together. By shading the zones so created, an easily interpreted and clear plan of the varying deposits was obtained. This was repeated for the other recordings, and gave plans for winter, spring and summer seasons.

The results of the lead peroxide gauges were treated in the same manner, and gave contour plans of

SO₂ concentrations.

The survey also included the measurement of natural ultra-violet rays by means of the Ashworth recorder. In this direction valuable assistance was received from Dr. Ashworth, the inventor of this instrument. It was impossible to obtain the negative necessary for the portrayal of the intensity of the rays, but it was found possible, on the recommendation of Dr. Ashworth, to use a prepared dichromated paper, details of which he supplied.

Many other recordings, which are known or thought to have an effect upon the problem, were made. These included rainfall, maximum and minimum temperatures, humidity, cloud cover, wind variations and strengths, etc., and these were obtained by standard methods and the use of standard instruments.

The Results

The results of the survey were submitted to the Department of Scientific and Industrial Research and were approved. The recordings of deposits proved without doubt that industry is mainly responsible for this form of pollution. The three recordings all show the density to be greatest from the south-west to the centre of the town, the area in which are situated the heavy industries. This area has an average annual deposit of between 1,000 and 1,500 tons per square mile, and in localised areas within this zone as much as 5,000 tons per square mile per annum has been recorded.

The weight of deposit recedes towards the north. This area is undeveloped land and in winter receives no greater weight than 250 tons per square mile per annum.

These figures seemed so high as to be inaccurate, but a check made with a standard deposit gauge in conjunction with the petri dishes sited in that area, proved their accuracy.

Calculations of the weight of smoke or suspended matter, from the stains obtained by the volumetric recorder, proved that 70 to 90 per cent. of smoke in the air of Bilston emanates from domestic chimneys.

Daily averages taken for weekdays and compared with those for Sundays, show that Sundays average exceeds that for weekdays. After making allowances for the few factories working

on Sundays, the domestic contribution was found to be that stated.

A study of airborne pollution revealed that the greatest density of smoke was brought to the instrument by northerly winds, i.e., from areas devoid of industries, whilst that brought from the south-west, the industrial area, was considerably less.

The results of the lead peroxide gauges also showed the greatest concentrations to be in a zone covering the old residential area of the town. This area included the group of houses surrounding the fire station previously mentioned.

Figures for this area are as high as 3.247 milligrams per 100 square centimetres per day in June, a summer month, and on the average are two or three times greater than the lowest recorded in Bilston, and seven times greater than that recorded at the waterworks in the rural area.

A study of airborne SO_2 pollution revealed that winds from the north-north-west, east-south-east, and south-west, gave the highest concentrations. These vary from those for smoke, but with the exception of that brought by the south-west wind, it can be attributed to residential areas.

Daily averages, calculated as for smoke, proved that the domestic contribution varied from 60 to 80 per cent. of the whole.

Public Reaction

The reaction of the general public to this research, which has of necessity received some publicity, has been very marked. It is generally agreed that there is an urgent need for a considerable reduction, or better still the elimination, of atmospheric pollution, but it is a different matter to convince them that to do this corrective measures would have to be applied to the domestic grates burning bituminous coal. The fallacy seems fixed in their minds that industry is responsible for all forms of pollution, and any suggestion to the contrary is not readily accepted. Suggested remedial measures to the domestic grate, or the use of smokeless fuels and in particular other forms of heat, are therefore looked upon with disfavour. The lack of ultra-violet rays; the cost of pollution; the effect upon health, etc., would be willingly borne rather than forego the existing coal fire.

A detailed report of the survey was considered by the Borough Council, and the findings together with the recommendations had a mixed reception. Whilst agreement was generally expressed with the necessity for some action to be taken, the greater use of gas, electricity and smokeless fuels was not considered practical, due to the increased cost of such forms of heating. There was the same feeling of reluctance, by some members, to forego the existing domestic grate and the use of bituminous coal. The indirect costs of extra washing, cleaning, injury to health, etc., were not apparent to such members, but to the enlightened, the implications were obvious.

The report was, however, considered to coincide very closely with the other data obtained in the Civic Survey, and it was felt it would be of material assistance in the formulation of plans for the re-development of the borough.

Recommendations were also made to the Ministry of Health, based upon the evidence submitted, asking for consideration to be given to many suggested measures for the control or elimination of atmospheric pollution from all sources, and which, it was felt, if adopted and made law would be of considerable assistance.

Railroad Smoke in Pittsburgh

Sumner B. Ely, Superintendent of the Pittsburgh Bureau of Smoke Prevention, in a report quoted in *Smoke*, the bulletin of the Smoke Prevention Association of America, states that the railroads are trying to obey the smoke ordinance. They have appointed competent smoke inspectors to work with the Bureau and have shown the highest type of co-operation. Among the means used to eliminate smoke are:

(1) All road locomotives used in the city are equipped with brick arches and nearly all of them are equipped with mechanical stokers.

(2) Enginehouses in the city are equipped with oil burners for building locomotive fires from the top.

(3) Low volatile or so-called "smokeless" coal is used on yard locomotives, and, in addition, on road locomotives prepared for service at enginehouses in the city, 1,000 lbs. of low volatile coal is placed on the front of the locomotive tender to assist in building up the fire.

The Yorkdale

Back-to-Back Range

MANY Housing authorities have a preference for the back-to-back range, in which one fire serves to warm the living-room and to heat an oven in the kitchen as well as giving hot water supply. Up to now it has been difficult to obtain smokeless heating with such an appliance, but Messrs. Wilsons and Mathieson's, Ltd., of Leeds, have now developed a most satisfactory installation in their new "Yorkdale" Range.

The fire in the living-room is an "openable" stove of the new type, which, when the doors are opened and pushed back into the recesses at the sides of the stove, has an appearance differing little from the ordinary open fire. The stove can be closed at night, or as required during the day, and will remain alight overnight without attention, thus maintaining continuous warmth in the house and an ample supply of hot water. This type of stove will burn all kinds of smokeless fuel, including coke, anthracite, "Coalite," "Phurnacite," the Welsh smokeless coals, and, if necessary, bituminous coal.

On the kitchen side is a oven heated from the fire, combined with a "New World" gas cooker with "Regulo" control. This admirable arrangement enables the housewife to carry out the daily cooking either by solid fuel or gas, according to climatic conditions. The gas rings, of course, are always available. During the summer a very small fire, with the stove doors closed, will maintain the hot water supply without over-heating the room.

The illustration shows the kitchen together with the duct which contains the flue for the combustion gases and which makes it unnecessary to build in a chimney breast or a recess for the grate. This is important in reducing building costs and providing more floor space. The partition wall between the living-room and the kitchen may be of any thickness from two to six inches.



Kitchen side of the Yorkdale, showing ovens and duct.

Additional warmth is provided by the use of convected heat. Fresh air can be brought into the duct from the outside and warmed before being discharged into bedrooms on the first floor through controlled ventilators at skirting board level.

If desired, a hot water radiator may be installed either in the hall or on the landing, or, alternatively, there can be a heated towel rail in the bathroom.

On the grounds of efficiency and economy, as well as smokelessness, this installation appears to us to be of a very satisfactory nature, and we strongly recommend all Housing authorities to inspect and consider it.

This is one of the appliances on view at the C.U.J.C. exhibition of new fires and cookers, at the Building Centre, Conduit Street, W.1, which opens as we go to press. It will be open from 10 a.m. to 7 p.m. on weekdays until 30th June.

A.G.M. RESOLUTIONS

Two resolutions, addressed to local authorities and Government departments, respectively, were adopted at the Annual General Meeting on 22nd February. They read :

- (1) That this meeting of the National Smoke Abatement Society urges all local authorities which acquire land for the purposes of re-development and reconstruction, to ensure that, when the land is re-developed for industrial purposes, the leases to the occupiers will contain such provisions that all installations of solid fuel-burning plant will be efficient for their purpose and as smokeless as possible, and that for that purpose shall submit plans of such installations to the local authority for their approval before use.
- (2) That this meeting of the National Smoke Abatement Society welcomes as a necessary first step

towards the abolition of domestic smoke the relevant Government statements and recommendations contained in the Housing Manual, 1944, and urges that :

- (a) the importance of adopting these recommendations is clearly brought before all housing authorities ;
- (b) ways and means are considered for the adoption of the recommendations in all privately built houses ; and
- (c) an early examination be made of the methods and requirements for the progressive elimination of all domestic smoke so that all building, planning, and the development of the production and use of smokeless fuels and suitable appliances may be consistent with and help to promote such methods and requirements.

Diesel-Electric Shunting Locomotives

One of the difficult problems in the prevention of smoke from the railways is that caused by the conditions inseparable from shunting operations. There is an additional nuisance factor that, unlike the smoke from a travelling

locomotive, it continuously affects the same neighbourhood. The development of diesel-electric locomotives for shunting purposes is therefore to be welcomed.

The L.M.S. has obtained considerable experience in recent years and are apparently finding that these locomotives have many advantages, and in the opinion of the L.N.E.R. the 350 B.H.P. diesel engine has established its capacity to do all the work of a normal shunting yard in this country. They are therefore building four locomotives of this capacity at their Doncaster works. The locomotive weighs 51 tons in working order, and a starting tractive effort of 32,000 lb. can be obtained, which will be maintained up to 2 m.p.h., while the maximum speed is 20 m.p.h. The photograph shows one of the L.N.E.R. locomotives.

(Block kindly loaned by BEAMA Journal).



External view of diesel-electric shunting locomotive with roof and side covers open.

The Conference

*Some Impressions and
Afterthoughts by*

M. Barash, Ph.D., F.R.I.C.

THE Conference held in London on 23rd February, 1945, under the joint auspices of the Institute of Fuel and the National Smoke Abatement Society may be considered to have been a resounding success. A series of eight papers by notable authorities was excellently delivered and very ably discussed. A mass of useful data—historical, economic, hygienic and aesthetic—was disseminated to and absorbed by a very appreciative and enthusiastic crowded audience. One could not help feeling that here was “preaching to the converted” with a vengeance! And one cannot help asking oneself “How has the proselytizing gone since?”

The morning Chairman, Sir Lawrence Chubb, in opening the proceedings pointed out that besides the representatives of the Institute, of the Society and of many other organisations, there were about 220 representatives present appointed by the largest local authorities in the country, so that the Conference could properly be said to represent the considered opinion of the country; while the blessings of the Government on the proceedings were conveyed on behalf of the Minister of Fuel and Power by Mr. Tom Smith, Parliamentary Secretary to the Ministry. Not a single dissenting voice was heard during the Conference—not a single criticism against abolishing the evil of smoke emission. One is tempted to ask “So now what?”

Mr. Smith discussed the question of compulsory smoke abatement, which has been strongly advocated by many, but feared that the people of this country were largely conservative; they did not like change and they did not like compulsion. He stated that the Minister emphasised the need for educating the public by sensible propaganda—“we could not expect to get smoke abatement until the country really wanted it”—and he stated on behalf

of the Ministry that whatever help they could give in this matter would be gladly given.

It is apparently axiomatic that normally, before any great innovation for the amelioration of living conditions is put forward by the Government, the public must be carefully prepared for it and made willing to accept it.

It certainly appears that the time is now ripening for the innovation of protecting the people's health (and pocket) by a final propaganda push for smoke abatement, and it would be a great pity if this opportunity is missed.

The proffered help of the Government should not be neglected. A country-wide educational campaign must be instituted. The children in all the schools should be made smoke abatement conscious. Lectures on the evils of atmospheric pollution and on its elimination should be given as frequently as is practicable in every schoolroom. The prize essays scheme in girls' High Schools already voluntarily inaugurated by a member of the Society is most commendable and merits considerable development.

As a measure of post-war reconstruction it can be shown that by the consumption of fuel smokelessly at an increased efficiency of only 20 per cent. (readily achievable) the saving of fuel from the 40 million tons consumed annually in the domestic smoke-producing grate (at only about 20 per cent. efficiency) would be in the region of 20 million tons of coal per annum, worth nowadays about 50 million pounds sterling. If to this is added the costs incurred by the individual to overcome the evil effects of the smoke (reasonably computed at £1 per head per annum) a total National saving of some 100 million pounds per annum could be effected—sufficient to pay the interest on about 3,000 millions of our National debt—or giving material help in our essential trade competition in international markets through the reduction in our own cost of living.

But financial considerations apart, there is here a golden opportunity for this generation to hand down to posterity the benefit of a clean unpolluted atmosphere, a benefit which will go far to mitigate the burdensome heirloom of the aftermath of this War.

SMOKE PREVENTION ABSTRACTS

29. Flue Collection in Central Stations—Review of Current Practice (F. Alton, *Elect. Industr.* 1944, 44, 188; Beama, J., 1944, 51, 248). The recommendations of the Electricity Commissioners set a dust discharge limit that can be attained with efficient flue dust cleaning equipment as it is commercially available to-day without requiring any excessive capital outlay. After noting this, the author mentions some of the methods—centrifugal separation, gas washing, and electrical dust precipitation being of special practical importance. The principle and operation of these types are described, with diagrams and illustrations. The design of the centrifugal type is a difficult aerodynamic problem, but by persistent research and experiment remarkable efficiencies have been obtained, the Davidson "D" type being mentioned as securing collection percentages ranging from 92 to 98 per cent. The Howden-I.C.I. flue gas washer is given as an example of the second type familiar in large power stations and found efficient. The third, electro-precipitation, has made remarkable advances in recent years, and the Lodge-Cottrell design is here described.

30. Industrial Fumes and the Damage they can cause to Surrounding Vegetation (S. G. de Haro, *Ion*, 1943, 3, 621. *Chem. Abstr.* 1944, 38, 2763). Damage caused to vegetation by acid fumes contained in the smoke from industrial plants is studied extensively. The best known methods used for the determination of SO_2 in the fumes and in the plant parts are described. Several steps for preventing such damage were tested. The best results were obtained with special installation based on a formula, the essential factor of which is to increase the quantity of gases by injection of air by a ventilating system, helped by a conically-shaped chimney and insertion of a rotating device. This system can be preceded by washing of the gases. The problem is studied for Spanish conditions.

31. The Need for Investigations in Nature of Damage by Waste Gases (W. Mühlsteph. *Chemikerztg.* 1942, 66, 436. *Chem. Abstr.* 1944, 38, 1811).

Many investigations of smoke damage during the last two decades have placed an over-valuation on the chemical analysis of air in the neighbourhood, and have not given proper weight to the examination of the objects suffering from damage. Observation of damage is quite as important as analysis for sulphur dioxide, said to be the most widespread plant poison. In the case of dust, its arsenic content is the determining factor as to the harm it produces.

32. Zonal Heat Distribution as a Step towards District Heating (Musgrave, J. L., *J. Inst. Heat. Vent. Eng.*, May-June, 1944, 12, 42). Examines the possibilities of central fuel-oil distributing systems, electricity (for background heating) and high-pressure hot-water supplies, with a view to their place in post-war housing and reconstruction schemes. Methods of installation are discussed, with comparative costs of oil-firing and low-temperature electric warming. Numerous suggestions are made for assisting a transition from the heating of individual buildings and dwellings to some form of district heating.

33. Trends in the Design of Heating Installations for Domestic Purposes (Egerton, Sir Alfred C., *Heat. Vent. Eng.* 18, 177, Nov., 1944). Setting as the aim of a domestic fuel policy a reduction in coal consumption from about 1.4 tons per head per annum to about 1 ton, with an increase in the general standard of heating, the author examines desirable conditions in the different rooms of a small house and in a two-storey block of flats, the latter being from a heating point of view more economical. The questions of insulation, the lining of rooms with a material of low heat capacity and good surface finish, and architectural layout and plumbing are briefly considered. The overall thermal efficiencies of available heating systems are tabulated, together with their costs; and a list of preferred combinations for different purposes is given.

Correction.—The measurements referred to in Abstract No. 24, page 60, Spring issue, 1945, were made in Dublin, and not Belfast as stated.



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*Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky ;
All bright and glittering in the smokeless air.*

SMOKELESS AIR

Quicker March

The reason for the late appearance of this issue of the journal is that the Society, largely through its own fault, has somehow got into a state of chronic activity. This complaint, which incidentally shows no sign of abating, will no doubt be regarded by observers as a symptom of vigorous health, but it is apt, all the same, to put plans and time-tables out of joint. *Smokeless Air* has had to take its place in the queue of jobs to be done, but it appears at last—and with the first of a series of new covers. Ahead of it in the queue were the three recent conferences, London, Southampton, Manchester, and a considerable task for the office in connection with the new constitution. This last goes on, especially with respect to

representation, voting registers, and the new scales of subscription, which are involving a remarkable amount of correspondence and detailed attention. Behind in the queue, and now coming forward, are the first elections under the new constitution and the first annual general meeting (new style), which it was agreed to hold as early as possible in the new year.

Conferences

Each of the three conferences was in its own way a great success : London, where the attitude of the Ministry of Health, as expounded by the Parliamentary Secretary, came as a shock of dismay to the delegates and produced a

sharp and even caustic debate ; Southampton, where new ground was broken with the help of a small but intelligent meeting ; and Manchester, where on old ground a meeting of record attendance was held. The Southampton meeting is reported on later pages, while London and Manchester are having their own separate reports—for Manchester a reprint of the report that will appear in the *Journal* of the Institute of Fuel. We would ask readers to note especially Dr. G. E. Foxwell's paper. In this he shows how the solid smokeless fuels required for the complete abolition of domestic smoke can be produced if we plan to do it. That this is the case needs emphasising repeatedly : so many people seem to think that because smokeless fuels are not immediately available in the quantities in which they will be required, we must accept the palliative of smoke reduction with bituminous coal. The latter may be useful temporarily, but what is required is that the development of smokeless fuel production should go ahead with all speed.

Smokeless Zones

A note on another page reports the almost simultaneous decisions of the City of London and Manchester Corporations to ask for statutory powers to establish smokeless zones. This is great news for the Society, which as members will know, originated and developed this principle for the progressive abolition of smoke. For the original conception, and for much of the subsequent development that has led now to practical action, the Society is indebted to its Chairman, Charles Gandy. We believe he first advanced the idea at a meeting for architects held in conjunction with the Society's big exhibition at the Science Museum, South Kensington, in 1936. By 1946 the chances are that the first smokeless zones will be in being—which is great progress for an entirely new smoke prevention principle. This action of the two great corporations is a tangible and encouraging sign that the Society's work is at last starting to meet with success.

Forcing the Pace

This beginning of success is, of course, the cause of the chronic activity already lightly mentioned. What seems

to be happening is that whereas up to now the Society has been exerting a pressure to get things moving, "things" are now starting to react and to exert pressure on the Society. The interest we have been creating is beginning to come back and to force the pace. This means that the Society must expand not merely to do the things it wants to do, but to do things that will come to it to be done. Already much of the routine work is service of one kind or another—supplying information, publications, advising on problems of all kinds, assisting in the activities of others—and it is not easy to do it all efficiently. To begin with, a new senior assistant is being advertised for, and another small office will have to be taken over.—Yes, dear reader, we are veering round to the hackneyed problem of income, but those who are familiar with the Society's finances will know how important it is. An item that is perturbing the Committee is that, unless something unforeseen can be arranged, we shall shortly be obliged to pay more than double our present office rent.

Alderman W. T. Jackson

We record with deep regret the death of William Turner Jackson, Alderman and former Lord Mayor of Manchester. He "fathered" the Wythenshawe developments, and did great work in Manchester's slum clearance schemes and in a job especially after his own heart, the founding of the Abergale Sanatorium for tuberculosis treatment. This was positive work for public Health, and it was the desire for this that made him so strong a fighter for smoke abatement. As Chairman of the Manchester and District Regional Smoke Abatement Committee, Alderman Jackson was responsible for a great deal of the progress made in and around Manchester, and it was largely because of him that the first approach of the Society about smokeless zones was so favourably received. But for the war he might well have become the first chairman of a Statutory Board for the district, towards the formation of which good progress was being made up to September, 1939. Alderman Jackson's personal efforts were partly responsible for the agreement of 24 authorities around Manchester to join the proposed Board. It is a pity that he was to see neither this nor his city's first smokeless

zone. He worked hard for the conditions needed for public health. He was a man of remarkable character, in whom gentleness and kindness were combined with clarity of thought and that rarer quality of wisdom.

Sheffield Replanned

We have received a copy of the town-planning report of the City of Sheffield which, in its chapter on general development has a section on smoke abatement. It stresses that even in Sheffield the most serious offender is probably the domestic fire, and suggests that appreciable progress will not be made unless smokeless zones are prescribed. On the industrial side it is said that gas and electricity will play an increasingly important part, and that "in our new light industrial areas there should be no great difficulty in ensuring the minimum of nuisance from smoke. In the heavy industries the problem is more difficult, but as the modernizing and extension of plants takes place the application of new and more economical methods of fuel consumption will provide a steady and progressive amelioration. In the matter of smoke and soot, Sheffield has in the past held an unenviable record; yet there is no reason why, if the problem is tackled in earnest, we should not quickly rid ourselves of it to a very considerable extent." Frankly, we are disappointed that Sheffield has not been able to look at the future with any greater confidence than this.

Manchester Plan

Much more radical is the outlook on smoke revealed in "City of Manchester Plan," a weighty and engrossing volume which has been received only just as we go to press. A full review will be given in our next issue of its excellent Chapter 17, firmly entitled "Abolition of Smoke."

NOTICE TO MEMBERS

For the purposes of nominations and, if required, balloting by post for a President, Hon. Treasurer and 30 members of the Executive Council under the provisions of the new Constitution, a Voting Register is being prepared for each Division. These registers will include only the names of subscribing Individual Members and of the appointed Representatives of subscribing Corporate, Institution and Local Authority Members. Only those whose names are included in the Registers will receive election communications and will be eligible to be nominated, to nominate, or to vote.

Subject to final confirmation, the Annual General Meeting will be held at the Horticultural Hall, Vincent Square, S.W.1, on the afternoon of Thursday, 21st March, 1946. Details and full Agenda will be sent by post to all Members and Representatives.



EXHIBITION

The meeting is being arranged in conjunction with an important "Good Heating for Every Home" Exhibition, under the auspices of the Solid Smokeless Fuels Federation, to be open at the Horticultural Hall from March 7th to 27th. This will show all types of new domestic appliance suitable for solid smokeless fuel. Smoke abatement will be stressed and the Society is to take a stand. A number of the appliances will be in operation, and all information about them will be obtainable at the Exhibition. The event should be of considerable help to Housing Authorities.

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MANCHESTER AND CITY OF LONDON MOVE FORWARD

“Prior Approval” and Smokeless Zone Proposals Approved

W E put Manchester first in the headline because it was the first to make the move, even though the City was first to give final approval to the proposals. The Manchester Public Health Committee recommended, and it has now been agreed by the Council, to include in their next General Powers Parliament Bill a clause which will permit the setting up of smokeless zones. For further information about Manchester's action reference may be made to Dr. Metcalfe Brown's recent paper, reported on another page.

In the City of London a special committee has recommended, and the Common Council has agreed, to make application to Parliament for powers—to quote the report—“to require that in new buildings, plans and specifications for heating arrangements, whether for the generation of power, the warming of rooms, the heating of water, or the cooking of food, should be submitted to the Corporation for approval,” and also to give the Corporation power to declare any area of the city a smokeless zone.

In these cases one or both of the two most important powers that can at the present time be obtained for the prevention of smoke, are being asked for. Such action, by two of the principal local authorities in the country, brings at once the Society's proposals into the realm of practical politics, and the Society has every reason to be pleased with itself and with the way its policies are progressing. The Manchester Bill is expected to come before Parliament early next year, and it would seem that the City of London's proposals will also reach that stage at about the same time. That will be a moment of great importance, and members may be assured that the Society will be very wide awake.

District Heating—and Town Hall Reform

This action does not, however, com-

plete the story of London and Manchester. The Manchester Bill will also ask for powers to establish a district heating scheme at Wythenshawe, and in London the Improvements and Town Planning Committee has been instructed to report on the practicability of including in the rebuilding plans a scheme for district heating. In proposing this, Sir George Elliston said that there were areas between Fetter Lane and Farringdon Street, Aldersgate and Moorgate, round St. Paul's, and in the neighbourhood of the Minories which offered unique opportunities for smokeless zones. In these areas nearly three thousand properties must be rebuilt. He thought the matter should be tackled now before property owners decided to provide their own heating installations.

Manchester has taken an immediate and very practical step: the Town Hall Committee has decided that, to encourage smoke abatement, all remaining coal fires in the Town Hall—about twenty of them—are to be replaced by gas and electricity. (All other municipalities please note!).

Manchester of the Future

Looking further ahead, Manchester has been holding a large and fascinating exhibition of plans for the development and improvement of the city. A book has also been published in which the plan is explained. The need for smoke abatement is fully emphasised, and it is shown that the ultimate elimination of smoke is indeed an essential part of the plan. It is an interesting comment on the growing awareness of this need that written comments invited at the exhibition and handed in at the rate of fifty a day showed that the two subjects most in the public mind were railways and smoke abatement.

The cartoon on the opposite page, by Wallace Coop, is reproduced, by kind permission, from *The Gas World*.



Manchester Man : Sithee lass, owd sol ! A vision of the future !

Manchester Woman : Champion ! Let's hope it's more than a dream.

Smoke Prevention in the South

Four Societies' Conference at Southampton

A SUCCESSFUL smoke abatement meeting was held in Southampton on November 8th. In an area that has hitherto seen little activity of this kind a large audience was not expected, but the fifty or more who were present for the morning and afternoon sessions were keenly interested and ensured animated and constructive discussions. The conference, on smoke prevention in post-war planning, was arranged jointly by the Society and the Society of Medical Officers of Health (Southern Branch), the Sanitary Inspectors' Association (Southern Centre), and the Southampton Civic Society.

The morning session was presided over by Alderman F. Woolley, J.P., chairman of the Reconstruction Committee of the Southampton City Council, and a welcome was extended to the delegates by the then Sheriff of Southampton, Alderman H. Vincent, who is now the Mayor. A vote of thanks to him was moved by Mrs. Des Voeux, who lives near Southampton, and who first suggested the holding of such a meeting.

The one paper read at the morning session was by Major S. F. Markham, on "The Atmosphere and Civilisation." Those who were fortunate enough to be present at the London conference in February last will know how engrossingly interesting he was on that occasion, and at Southampton too, the meeting found his subject matter, unexpectedly novel and challenging in some respects, to be an inspiration. Once again he traced the influence of climate on civilization, and showed how control of indoor climate was largely responsible for the rise of cultures such as our own. Coal and the introduction of the chimney had made our present civilisation possible, but in our misuse of coal we had degraded our natural climate, and much of the energy we were able to conserve by artificial heating was lost in combating the effects of a smoke-laden atmosphere.—However, instead of attempting here to

give what would be only a most inadequate summary, we would urge the reader to study the paper as Major Markham read it at the London conference. It is to be found in full in the Report of that conference, about which an announcement is made on another page.

Dr. Metcalfe Brown

At the afternoon session the chair was taken by Mrs. (then Alderman) B. Leach, of Southampton. The first of the two papers was by Dr. Metcalfe Brown, Medical Officer of Health for the City of Manchester, and a member of the Society's Executive Committee. His subject was "Planning for Smoke Prevention," and we should have liked to be able to reproduce his address in its entirety. Some excerpts of especial interest can, however, be quoted in full.

"The effect on the health of the dwellers in smoky towns," said Dr. Metcalfe Brown, "of the all-pervading gloom which is the handmaiden of smoke is difficult to estimate, but there is no doubt that it is bad. It is a commonplace that mental depression and ill-health are boon companions—that grief, worry, fear and the like depress the feeling of well-being, and so do gloomy surroundings, the gloom due to the cutting off of sunshine by smoke, and because buildings and walls are so begrimed that they are dark and dingy."

Speaking of the future, the speaker said that "smoke abatement Boards should be organised to cover the whole country in regions so that an agreed regional policy may be laid down suitable for and acceptable to each region concerned. Statutory powers should be conferred on these Boards in order to give them effective control of smoke, both industrial and domestic. It will be agreed that it is poor encouragement to a progressive authority which may be using its limited powers to the utmost extent, to find that of its less progressive neighbours, those to the lee side get the

benefit, whilst those on the windward side send over their unwanted smoke. Joint action by neighbouring local authorities, based on statutory powers, would ensure that each and all would enjoy the fruits of their effort or at least they could claim

*'Tis not in mortals to command success,
But we'll do more, Sempronius; we'll
deserve it.'*

Smokeless Zones

Of particular topical interest was the information given about the smokeless zone proposals in Manchester :

"In October, 1945, the City of London decided to seek Parliamentary powers for the declaration of smokeless zones. In 1938, the National Smoke Abatement Society requested the Public Health Committee of Manchester to consider the advisability of recommending the Council to acquire power to prescribe smokeless zones in the city. The central area of the city was suggested in particular. The Committee instructed the Medical Officer of Health to survey part of the central area with a view to further consideration being given to the matter. This survey was undertaken and covered an area of about 104 acres. It was found that a great majority of the plant and appliances were already capable of being operated smokelessly, and that there was no reason why the occupiers of other premises with smoke producing apparatus should not fall into line with their more enlightened neighbours. Owing to the commencement of hostilities no further action was taken in this matter but it was clearly demonstrated by the information then obtained that it would be practicable in the area concerned to declare a smokeless zone in which the emission of smoke would be prohibited.

"During the war, many buildings in the proposed smokeless zones were destroyed by enemy action, thus leaving cleared sites which, if included in the smokeless zones, are capable of development on smokeless lines without difficulty or hardship.

"In view of the post-war planning requirements, the re-location of industry and the further step in smoke abatement, it is considered desirable that the Corporation should have power at some future date to prescribe areas or zones in the city in which the emission of



Major S. F. Markham, M.A., B.Litt.

smoke of any colour or density would be prohibited.

"In May, 1945, the Public Health Committee recommended that clauses to prescribe smokeless zones or areas in the city be included in the next Parliamentary Bill.

"The possibilities of smokeless zones are enormous. It is true that just as the smoke-conscious local authority will derive little benefit from its conscientiousness, because of the lack of conscience of its neighbours, so the smokeless zone will still be smoky as a result of the products of neighbouring non-smokeless zones. But the creation of a smokeless zone is a start—other separate smokeless zones may be created as opportunity presents—to each smokeless zone may be added additional areas so that gradually the smokeless zones increase both in number and in size until in the course of time they coalesce and form one vast zone.

"This method, the creation of smokeless zones, appears to present the best chance of ultimate success of all the various suggested means of smoke abatement in the future.

"The creation of the garden village of Wythenshawe by the City of Manchester and its final incorporation into the city in 1931 is well known. What

is perhaps not so well known is that the industrial estate of Wythenshawe has been developed by the Corporation, which since it owns the freehold of the land, was able, and in fact did, require that the leasehold agreements contained protective clauses against smoke, including regulation of the type of appliances to be installed. As a corollary the opportunities of full utilisation of electricity and gas were thoroughly investigated, with satisfactory results."

The author considered the prospects of district heating and of smokeless fuel, and in conclusion said: "Let us realise that in smoke abatement as in many other matters we are at the cross roads and never before has such an opportunity presented itself for really effective measures in relation to smoke abatement. In one direction there is the road of *laissez-faire*—we shall build new homes, offices and factories on the old traditional styles with the wasteful, dirty, inconvenient methods of heating, with all the drudgery they mean for our womenfolk and all the damage which a smoke-laden atmosphere means to the health of the people. We live in difficult times, and the old warning, 'Waste not, want not,' is both an indication that we shall suffer accordingly if we waste, and a guarantee that we shall survive if we do not. The other road is the way of wisdom—the use of scientific methods, economically sound and productive of higher standards of comfort and of better conditions than ever before."

Mr. L. A. Stroud

The final paper was on "Smoke Prevention in New Housing," by Mr. L. A. Stroud, Chief Sanitary Inspector of the Borough of Slough. Again, we should like to record the whole of an excellently reasoned paper, but must be content with a few extracts only.

"It is desirable," said Mr. Stroud, "that within the limits of national consideration the domestic household should be given freedom of choice between solid fuel, gas and electricity as may best suit his, or her, household arrangements. National interest demands consideration of smoke abatement and prevention, and in considering smoke prevention in new houses it must be borne in mind that the income of the occupants will largely govern the type of fuel to be burned and consequently the appliances to be used for

supplying space heating, radiant heating, domestic hot-water supply and facilities for cooking and clothes-washing and drying.

"I would submit, therefore, that the problem before us is one of both social duty and economic consideration. The Housing Manual stresses the housewife's point of view—simplicity, efficiency and running cost. The co-operation of the individual family is essential if success is to be attained."

After further referring to the Government's Housing Manual, the author considered solid fuel: "The three main methods by which the domestic smoke nuisance may be reduced or eliminated without abolishing the use of solid fuel are (i) by the use of solid fuels which are smokeless, either naturally or by carbonisation; (ii) by better cleaning and preparation of coal for the market, thereby reducing its impurities, particularly from iron pyrites which is responsible for causing sulphur dioxide; and (iii) by the more complete combustion of raw bituminous coal.

"From a smoke abatement point of view it is necessary that the available supply of smokeless fuels should be increased and in post-war years this will probably take place to the gradual elimination of bituminous coal for domestic purposes, but I am of the opinion that it will be several years before raw coal can be entirely replaced by other fuels."

The paper went on to discuss space heating by solid fuels, the continuous burning open fires, openable stoves, and back-to-back ranges, space heating by gas and electricity, and automatic heat from solid fuel. The importance of thermal insulation was also considered.

"In considering domestic heating appliances the provision of thermal insulation to the house structure is a matter to be taken into account, as the prevention of the loss of heat, in the case of bituminous coal means not only economy in fuel but a reduction in smoke emission. It has been estimated that the annual heat loss of the small house of normal construction is in the region of 24 million B.Th.U.s and the amount of fuel required to provide this heat will depend on the efficiency of the heating appliances and the methods of use.

"If appliances are fully controlled so that the heat output can be closely

related to the heat requirements, theoretically the full benefit of thermal insulation will be obtained. Unfortunately, this cannot be obtained with those solid fuel appliances now in general use, but will with newly-developed appliances. At the present time many new housing planners regard the cost of providing thermal insulation as prohibitive.

"I feel," said Mr. Stroud, in conclusion, "it would be an important step towards procuring smokeless zones in new housing if Housing Managers and Welfare Workers were soundly instructed in the use of smokeless fuels and the urgent need for domestic smoke prevention, so that this knowledge could be propagated to the occupants of the many new houses which will be erected throughout the country during the next few years, and I am confident that much good would result therefrom.

"The adoption of newly-developed fuel-burning appliances in new housing will, in considerable measure, prevent the creation of new sources of atmospheric pollution by domestic smoke, but the more difficult problem is of dealing with existing sources of domestic smoke pollution. This is a problem of its own and one of some magnitude which will involve a programme of progressive elimination by replacing smoke producing appliances in existing dwellings, and one hopes that the benefits secured in new housing will be reflected by the adoption of new appliances in existing houses."

Among those taking part in the discussions were Dr. Williamson, Medical Officer of Health, Portsmouth; Mr. R. W. Watridge, Southampton Borough Analyst; Mr. S. E. Whitehead, managing director of the Southampton Gas Company; Mr. W. Conley, of the Southampton Electricity Department; and Mr. H. L. Snowden, Chief Sanitary Inspector, Farnborough. Among those on the platform were Mrs. H. A. Des Voeux, Dr. Williams, Medical Officer of Health, Southampton; Mr. Stewart Swift, president of the Southern Centre, Sanitary Inspectors' Association; Mr. G. M. Radwell, hon. secretary of the Southampton Civic Society; and Mr. Arnold Marsh, secretary of the National Smoke Abatement Society.

New N.S.A.S. Publications

Joint Conference Report. Report of the joint conference with the Institute of Fuel, London, 23rd Feb., 1945. 8 Papers and discussions; 45,000 words.

2/6 each.

Improved Fuel Burning Appliances for New Houses. Report of Conference in London, 19th Oct., 1945. Containing address by Ald. C. W. Key, M.P., Parliamentary Secretary to the Minister of Health, Statement by the Executive Committee, and Discussion.

Ready shortly, 1/- each.

Domestic Fuel Efficiency and Smoke Prevention. Report of joint conference with the N.W. Section, Institute of Fuel, Manchester, 14th Nov., 1945. Papers by Dr. G. E. Foxwell, Charles Gandy, and Arnold Marsh, and discussion.

Ready shortly, 1/- each; 10/- per dozen.

The Smoke Problem and Science Teaching. A booklet for teachers, with notes and experiments. Just published.

3d. each; 2/6 per dozen.

Smoke Control. Suggestions to Local Authorities on Guidance and Control in respect to new Fuel Burning Installations. Just published.

3d. each; 2/6 per dozen.

Constitution. The new constitution of the Society in booklet form.

2d. each; 1/- per dozen.

All Publications Post-free.

NOTE.—Under the new constitution subscribing Individual Members and the appointed Representatives of other Members, may receive a copy of any of the above publications, free of charge, on making a request.

TAX REMISSION FOR SMOKE ABATEMENT?

To the Editor

Smokeless Air.

Sir,—Smoke emitted from chimneys imposes on taxpayers the need to fritter away money on soap, dry cleaning, repainting and the replacement of corroded metal articles. The installation and successful operation by anyone of smoke abatement apparatus saves money for other taxpayers.

Business men do not instal smoke abatement apparatus because it costs money and because the gain to the population as a whole is not shown by their present accountancy. I suggest that the Government should realise this and make a remission of tax to anyone installing smoke abatement apparatus, just as expenses incurred on research

have recently been freed from tax.

If Members of Parliament see this problem clearly they will know that smoke abatement is absolutely essential from the general health point of view, but that it is not now a commercial proposition from the individual chimney owner's point of view.

Legislation must, therefore, be introduced to compel or to encourage the quite feasible abolition of smoke. One way of encouraging this would be to offer relief from taxation on all expenditure incurred in minimising dust, sulphur, and smuts scattered on to the surrounding public.

Yours, &c.,

T. HENRY TURNER.

Doncaster.

Airmen and Smoke

In a letter to the *Rochdale Observer*, which had been pleading for a cleaner atmosphere, Flying Officer Arnold Chadwick (under the Meteorological Office), described some of the effects of Britain's smoke pall as seen by so many airmen during the last few years.

"One of the greatest handicaps to flying personnel is smoke haze, which can often affect country as well as industrial districts, dependent upon the wind direction, no area of our country being far removed from a large town or industrial region.

"An airfield a few miles from Cambridge, which is considered to be a residential university town, may be rendered unserviceable by Cambridge smoke. The visibility in the country area of the Vale of York can be reduced to fifteen hundred yards, and even less (in an atmosphere of high humidity) by smoke of the West Riding or Tees-side, as is also similarly the case south of Blackpool by smoke from Preston, Manchester, Liverpool and the other south Lancashire towns, the haze layer top averaging three thousand feet. Little, if any, of the ground can be seen from this height.

"In the latter instance, with a pre-

vailing south-south-easterly to south-easterly wind, which is very common in West Lancashire due to local topographical features, the haze layer extends well across the Irish Sea, completely covering the Isle of Man. A change of wind direction to light northerly in the south Blackpool area will often decrease the visibility from four miles to one thousand yards or less in half-an-hour, due to Blackpool smoke, this being mainly of domestic origin.

"Thus," concludes the letter, "these few examples, which I have often experienced (and there are many others) prove the necessity of efforts to minimise this nuisance and danger to aviation."

Science Teaching

Readers who are teachers, or have teaching friends, should obtain a copy of the Society's new pamphlet *The Smoke Problem and Science Teaching* (3d.). This is intended for science teachers, and shows how information and experimental work on smoke and air pollution can be introduced into ordinary lessons in science and related subjects. School children can be made smoke-conscious in interesting and practical ways.

News in Brief . . .

. It seems we shall have to take a leaf out of *The Countryman*, which more boldly than most periodicals ignores the conventions of sub-heading, paragraphing, and ruling in some of its features in order to give its readers a full measure of the information they pay to read. Perhaps we haven't such an interesting range of subjects, but we will try it, if only for this once, when a great and still growing sheaf of papers is waiting to be boiled down for the two or three brief columns that remain vacant.

★ Atomic energy was hailed by some as the means for finally ridding this country of its smoke. We believe it may help substantially in due course, but this may be a long time coming. If it is used, as seems probable, to heat water which will be used to generate electricity as at present, all the cost of generation and distribution will remain as they are, and the only saving will be in fuel. It will certainly not mean unlimited free energy or anything like it, and there may still be the thorny problems of load peaks, or if you prefer it, peak loads. ★ To those not acquainted with this technicality, it means that since electricity cannot be stored a power station must be capable of generating electricity at the rate of the greatest demand it is likely to have to supply. That greatest demand, which may last only a few minutes once a day (or even once a year) is the peak load. Stations have therefore to be far bigger than their average output requires, and this, of course, prevents costs coming down as otherwise they could. ★ Anything that helps to iron out peaks must help electrical development and smoke abatement, and we have been interested in a brochure sent us describing Actadis Ripple Control. By means of this a ripple in the wave-shape of the electric current can be used to operate switches, give signals, shut off circuits, and generally do the most unlikely things. It can be used to control street lighting and was used in the war to give special signals to C.D. people in their own homes. We are interested because it means, for instance, that a domestic hot water system can be installed to operate at a low cost at time of low load, and to be switched off by the Undertaking when the load increases. During the night, for

example, water could be heated, but, as the morning heating and cooking load came on a ripple in the wire would operate a relay in the water heating circuit and suspend operations for the time being. Another ripple would switch on again in due course. Information from Measurement, Ltd., Terminal House, Lower Belgrave Street, S.W.1. ★ A North-Western Fuel Luncheon Club, similar to that which is so popular in London, has been formed recently in Manchester. Its monthly bulletins show it is already a great success. Our Chairman, Charles Gandy, has been elected as the Club's Hon. Legal Adviser. Secretary, who will be glad to send particulars, is R. Baker, Selas Works, City Road, Manchester, 15. ★ W. Neville Warwick, in his presidential address to the Coke Oven Manager's Association in London (25th October) foresaw greater help for smoke abatement from the coking industry: "We can visualise an increasing contribution towards a smokeless country by wider use of the fuel provided by the coking industry. There is scope for enormous development of solid smokeless fuels in general." He also gave hope that the newer types of coke-oven would materially reduce their own pollution. ★ We should like to recommend *A New Introduction to Chemistry*, a new school text book by H. L. Heys, M.A. (Harrap, London, 6s. 6d.). This is profusely illustrated, and excellently brings chemistry into its right perspective in relation to everyday life. This concern with the practical consequences of chemistry make the book exceptionally interesting and readable. In the chapter on coal there is a section on atmospheric pollution, while further reference is made to the corrosion due to pollution in the chapter on sulphur compounds. These accounts are illustrated by photographs the Society has been pleased to lend to the author. ★ W. B. Kennedy, Manchester Smoke Inspector, read a very thoughtful and constructive paper at a Sanitary Inspectors' Association meeting in June. He reviewed the Society's Smokeless Zone proposals and advanced arguments for preferring control over the fuel used in the area, rather than control over the smoke emitted, as being the better way of enforcing smokeless conditions. The arguments are substantial and we

(Continued on page 35)

A NEW DOMESTIC HEATING SYSTEM

A NEW form of central heating, in which the whole of the house may be warmed, and hot water supplied, from a single appliance, is being developed and tested by the Rheostatic Company, Ltd., of Slough. The essence of the system is *control*. It is of course an absence of control that has made domestic heating arrangements generally so inefficient, wasteful and productive of smoke.

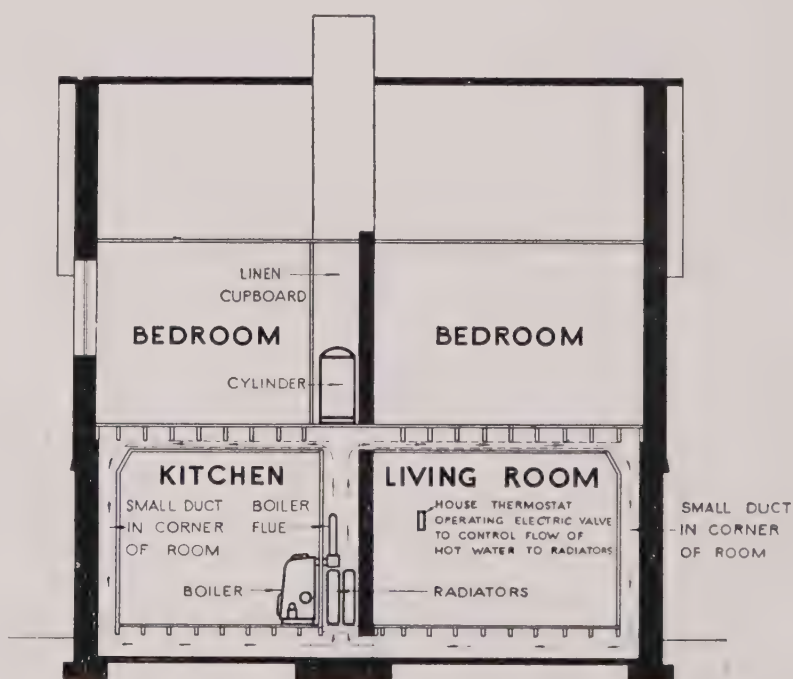
The system can be briefly described as follows. A boiler equipped with a gravity-feed magazine is installed in the kitchen, and there is no other visible apparatus throughout the house. Immediately behind the boiler, in the wall, is an air duct in which the air is heated by a radiator connected to the boiler. The warmed air flows upwards through the duct into the space between the ceilings of the ground floor rooms and the floors of the upper rooms. It then passes down ducts in the far walls, under the floors, and back to the original duct, when the cycle is repeated. The scheme will be made clear from the diagram, in which the pipes connecting boiler, radiator and hot water cylinder have been omitted for the sake of clarity. The ducts and air spaces between ceilings and floors are, of course, suitably sealed, as is the air space beneath the ground floor rooms. The air should spread freely beneath the floors and if in existing houses joists restrict this spreading it will be necessary to make alterations. In new houses modern constructional methods, which avoid any such difficulty, can be used.

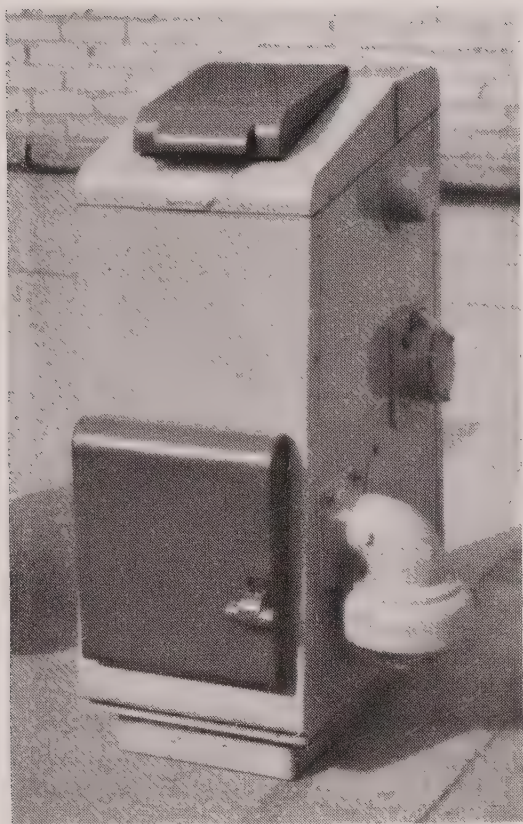
The boiler also supplies hot water for household purposes and a heated towel rail. A ther-

mostat on the boiler regulates the water temperature by controlling the primary air for combustion of the fuel. Another thermostat, in say the principal living room, regulates the house temperature by controlling the flow of hot water from the boiler to the radiator in the air duct.

The effect is that floors and ceilings act as low-temperature radiators, and give a uniform and agreeable warmth. The temperature gradient from floor to ceiling within the room, is said to be quite small. If it is required supplementary radiant heat in the form of an electric or gas fire can be used. Ventilation is given by wall-ventilators of a type that automatically control the rate of inflow of outside air.

With such a system full control of fuel consumption and of temperatures appear to have been achieved, and the apparatus required for the heating of the house has been reduced to a minimum in terms of both space and attention. The boiler magazine needs filling only once every 24 or even 48 hours, and the combustion is smokeless. The average small house of 900 sq. ft. can be warmed all over in this way and have a plentiful supply of





The boiler, with gravity-feed magazine and thermostatic control.

hot water for only $1\frac{1}{2}$ to 2 cwts. of fuel per week during the winter.

Even where hot water is supplied for a district heating system, rendering an individual boiler unnecessary, the principles described might well be considered for distributing the heat throughout the house.

News in Brief . . . (continued)

hope to discuss the paper more fully in our next issue. ★ Public opinion is rapidly coming to the stage of accepting the prohibition of raw coal in smokeless zones, and expects this to be a prominent part of the Society's policy. It is, in fact; but we must at present give more attention to *installations*, which are permanent, rather than fuels, which can be changed at any time. ★ *The Medical Officer* says some nice things about smokeless zones in a leader of 11th August. Obstructing change to smokelessness, it says, are three traditions—that an Englishman's home is his castle in which he must be free to do as he likes; that the coal fire gives a healthy form of ventilation; and that nothing

must interfere with the freedom of commerce. All three have become obsolete. "Freedom to do what we choose in our own homes has always been limited to doing anything we please which does not impinge on the liberty and amenities of our neighbours. We are free to kipper ourselves: we should not be free to smoke out our neighbours." ★ "Those who live in the unspoilt parts of England, away from the London area, the industrial Midlands, or the industrial North, have little appreciation of the decay of arable farming brought about by the spread of industry and of urban area. Smoke pollution, trespass and sparrow damage militate against cereal growing over vast areas." So writes Dr. G. H. Bates in *Agriculture To-day and To-morrow*, which comprises a series of addresses given to the Royal Society of Arts. He continues: "Smoke is by far the worst factor, the air is polluted, the vital rays of the sun are excluded and soil is rendered so acid as to become infertile. . . . It is not realised that smoke damage may be prevalent within a 10 mile radius of some of our cities. The prospects are even more alarming when one considers the proposals of the planning experts to disperse and decentralise industry." ★ Just as we go to press we have received a copy of the long-expected report of the special survey of air pollution carried out at Leicester during the years 1937-39. The report, entitled *Atmospheric Pollution in Leicester: A Scientific Survey*, is published by H.M. Stationery Office at 3s. It is an important publication and we shall review it in full in our next issue. It records the most extensive and detailed survey yet made of the distribution and dispersal of pollution. Unlike previous publications of the Investigation of Atmospheric Pollution the report ventures into the field of prevention, but as far as can be seen from a rapid glance through its pages, only very slightly. The criticism of smokeless zones is very reminiscent of the famous question about the use of a new-born baby. ★ Yorkshire and district readers may like to note that on February 20th a joint meeting of the Society and the Yorkshire Section of the Institute of Fuel will be held in Doncaster. Place of meeting, the Danum Hotel, Doncaster. Subject, "Technical Progress in Smoke Abatement."

The New Constitution

AT its meeting in London on 19th October the Society revoked the constitution it has had since its formation sixteen years ago, and agreed to one that is in many respects entirely new. The change is a sign of growth and vitality. The old constitution had been adequate while the Society was small and could be run on more informal lines, and while the rules about subscriptions has to be carefully discreet. To-day, a larger and keener membership has itself demanded a thorough revision.

The chief change is that the former Council, to which every affiliated local authority and association appointed representatives, has disappeared. It was always a body of uncertain functions and awkward size, and latterly its membership had grown to about four hundred. Its meetings became increasingly rare, and it is safe to say that no one will miss it. The real work was done by the Executive Committee, and this now becomes an Executive Council which should be stronger and more representative. The happy-go-lucky method of electing its members has given way to a system of postal nominations and balloting which will ensure that all parts of the country are represented in proportion to their membership strength. For this purpose the Society is now divided into nine geographical divisions, and each member will vote only for candidates in their own division. Corporate and Institution members will be able to appoint two voting representatives, and local authorities may have from two to five representatives according to their population. The Council will appoint Committees to deal with different aspects of the Society's work—a division of responsibilities that should be of great value. The President and Hon. Treasurer will also be elected by postal nomination and ballot, but the Vice-Presidents, limited to 20, will continue to be nominated and elected by a show of hands at the Annual General Meetings. The President will not be able to retain office for more than two years.

The Divisions are, to begin with, electoral bodies, but there may be set up Divisional Councils to carry out local activities. This will be a valuable

development where it can be accomplished, but such organization will not be set up until there is a demand for it within a Division. The areas of the Divisions, by the way, are probably unlike those of any other regional groupings, and are based on a recognition of the fact that some parts of the country have, and are likely always to have, a small membership. Wales, or East Anglia, for instance, as separate Divisions, would probably always have a representation on the Council of less than one. The distribution of the smoke pall has in effect been taken into account in the constitution.

Subscriptions

Radical changes have been made about subscriptions. The minimum for individuals remains at half-a-guinea, but for other classes of member the former one guinea has been boldly cast overboard. It was, of course, really a case of "one guinea plus whatever you like to make it," which was not perhaps the most convincing way of stating what the Society considered membership to be worth. In its earlier days the Society did not expect much, did not get much, and was unable to do much. Now, the demand of members is that it must do more, must therefore have more, and can justifiably ask for more. To members who might ask what they will *get* for it, the answer is that whatever it is that induces them to subscribe at all, they will get it more abundantly. Bearing in mind that most of a small income must be spent in just keeping the Society in being, the larger subscriptions we are asking will enable a larger proportion of the money to be used for directly promoting our objects. It is rather like the familiar wording on a package: the large size at twice the price contains *three* times as much as the smaller one.

There are other changes in the constitution that will be of interest to all members, but space prevents further comment. It was not an easy task to evolve a new and in some ways rather challenging constitution, and it perhaps could not have been done, and so readily accepted, except by an organisation possessing an abundance of energy and determination. It is a promising step forward.

DISTRICT HEATING FOR HOUSING ESTATES

By A. E. Margolis

THE centralised supply of ready-made heat on tap, as provided by district heating, is for housing estates even of greater importance than for a central area of a town. In large buildings central heating boilers can easily be installed giving the occupants the benefit of sufficient and cheap heating; the greater convenience and the lower cost of district heating service is a considerable advantage but to a much lesser extent than for houses which cannot reasonably be provided with central heating boilers. The average type of house so far has been furnished either with open coal fires, which is a very expensive and laborious method of heating, or with gas or electric fires which are convenient but even more expensive than heating by open coal fires.

As a result the heating of houses in this country is generally on a much lower standard than that of offices and factories. The provision of homes with good heating and hot tap water is for the great majority of the population still a luxury, but it is actually of national importance. Good heating not only increases comfort but makes the houses in winter more spacious because

all rooms can be fully used. Heated bedrooms can be arranged as bed-sitting rooms and children can work or play undisturbed, thus giving to parents more privacy and better rest. When the home is comfortable the visit to a public house becomes less attractive and the meeting of friends at home is made easier. When all rooms of a house are heated dampness is completely eliminated and there will be less colds, rheumatism and other diseases.

It is generally admitted that district heating provides the most convenient method of heating and that the introduction of this service will eliminate the smoke nuisance from our towns and cities. The adoption of district heating involves, however, a considerable capital outlay and it is often questioned whether such an expenditure can be justified, in particular for the heat supply of housing estates.

The economy of district heating depends largely upon the density of the heat load and it is obvious that it is more difficult to design an economic scheme for a housing estate than for a central area of a town with a concentration of large buildings, or a factory district with a great demand for process

heat. In fact, experience on the Continent and in U.S.A. shows that most of the existing plants serve large office buildings, Government and communal buildings. There are, however, in U.S.A. a great number of smaller towns which have successfully adopted district heating. The illustrations demonstrate the wide range of district heating service in U.S.A., from skyscrapers in New York to modest houses in the town of Vir-



These houses, at Virginia, Minnesota, were built after steam had been brought to the section and have no chimneys. The snow, several days old, is soot-free.

(Courtesy of M. C. Bright)

ginia, Minnesota. In both cases the convenience of the service and the cleanliness of the air are particularly stressed. The small houses in Virginia, as shown, were built after steam had been brought to this section and have no chimneys; snow several days old is soot free.

The following statement of the Superintendent of Utilities in Virginia, Minnesota, Mr. M. C. Bright, is of particular interest.*

"Virginia, Minnesota, is the largest city in the United States that centrally produces and distributes heat throughout its entire community. Our city furnishes heat to almost all of our 13,000 residents and to our industrial and commercial establishments as well. . . . The city was able to develop and expand the heating and generating facilities out of current operating profits."

The gross income of the heating department covering the fiscal year ending September, 1944, was \$352,600 as against \$292,518 of the electricity department. These comparative figures should encourage electricity undertakings in this country to give more attention to the question of district heating. By adoption of district heating the waste of heat in cooling water is eliminated and the income of electricity undertakings considerably increased.

It should be noted that the climatic conditions in the State of Minnesota are much more severe than in this country. On the other hand, our heating season is of longer duration and the demand for hot water supply per head of population, is probably greater in this country than in Virginia,



Skyscrapers in New York with District Heating service.

(Courtesy, National District Heating Association, U.S.A.)

Minnesota. Furthermore, the heat is supplied there by means of steam of which only a small proportion is extraction steam from the turbines of the power station. In this country, however, the heat for space heating and domestic hot water supply can as a rule be provided by means of hot water, heated by exhaust steam. Owing to this and some technical developments which cannot be dealt with here the economic position of district heating services could be much better in this country than in U.S.A. Heat distribution by means of hot water makes possible the complete co-ordination of heat and electric power generation and supply, independently of the different load variations of both services.† So great is the saving in coal and economic advantage of combined heat and power generation that in Soviet Russia most of the new steam electric stations are

* The American Magazine, February, 1945.

† An Outline District Heating Scheme for London, by A. E. Margolis, "Engineering," 26th May, 1944.

already built for electricity and heat supply.‡ According to a more recent statement in the Proceedings of the Academy of Science in U.S.S.R., No. 3, 1943, "heatification has to determine the course in the development of electric power generation in U.S.S.R."

Unfortunately, this most economic method of heat and electricity supply can seldom be applied for housing estates unless the district heating service is made to include also existing sections of the town. The heat demand is usually too small to justify the erection of an independent combined power station. For the same reason exhaust heat can seldom be supplied from an existing power station. More often it may be possible to obtain the supply of live steam which is, under all conditions, cheaper than heat generation in an independent plant. The cost of transmission has, however, to be added and the economic range of heat transmission depends again upon the size of the housing estate. When thousands of houses are concerned a heat transmission at a distance of 2 miles and even more might be possible, whereas for an estate of five hundred houses a distance of half a mile might be prohibitive. The question is a very complex one and it is impossible to give general rules for the heat supply from power stations, be it for exhaust heat or live steam. Every case has to be investigated to suit local conditions.

The economy of a district heating service for a housing estate also depends largely upon the cost of the heat distribution system. This is not so much influenced by the density of population as by the layout of roads and the density of load per mile of street. The design of housing estates or new towns with due regard to the street load density is of great importance not only for the economy of district heating but for all other services as well.

When exhaust heat is not available the generation of heat can often be carried out with normal sectional central heating boilers burning coke. The most economic outlay is when the capacity of plant is capable of being limited to one attendant. The boiler plant and the heat distribution system of a housing estate comprise a number of units corresponding to the size of the

estate. At a later stage of development these units should preferably be supplied with cheaper exhaust heat.

When suitable water is available a single pipe hot water distribution system can be applied. In summer the water is heated to a temperature of, say, 140° F. as required for domestic hot water supply. In winter the water is heated to a higher temperature, say, 200-300° F., in accordance with the weather conditions, and taken through a heat exchanger for heating the water of the radiator systems. The primary water is cooled down to a temperature as desired for hot tap water supply. Any required balance of heat can be supplied by electric or gas fires.

It should be mentioned that the development of district heating would free the electric generating stations and gasworks from the ever-increasing peak demand of electricity and gas. There is practically no diversity of the heating load on a cold day and it is a well-known fact that the increase of generating capacity and of the distribution systems, merely to meet the heating peak demand, requires an excessive capital expenditure.

The saving in new electric generating plant, the preservation of older power stations and the saving in coal by combined heat and power generation create a sound economic basis for the general introduction of district heating in this country. The development of district heating on a large scale for existing built-up areas will then make possible the public supply of heat to practically all new housing estates.

In conclusion mention must be made to the possible future application of atomic energy. This discovery would not influence the development of district heating. Even assuming the extreme case that this energy could be produced at a lower cost than the energy of mined coal it would be used first of all for generation of electricity in the steam cycle, from which exhaust heat would remain available for heating purposes.

Annual Conference

The first of the Society's 2 or 3-day annual conferences since Cardiff in 1938, will probably be held during the autumn of 1946. Date and place of meeting will be announced in the next issue.

‡ District Heating in Russia, by A. E. Margolis, "Smokeless Air," Winter Spring, 1942.

SMOKE PREVENTION ABSTRACTS

34. **The Chemist and the Air** (M. P. Appleby, Dunn Memorial Lecture to Newcastle Sect. Soc. Chem. Ind. Chem. and Ind., 1945, **38**, 298). The author considered the three types of pollution, black smoke, dust and grit, and sulphur compounds, and showed that pollution by ash is most serious from pulverized fuel which is burnt in this country to the extent of $4\frac{3}{4}$ million tons per annum and contains 600,000 tons of ash, of which 60-70 per cent. goes into the atmosphere. The nuisance is best prevented by electrostatic precipitation or by water washing. Sulphur pollution is discussed.

35. **District Heating** (First Report of District Heating Committee of the Institute of Gas Engineers. Communication 286 of I.G.E.). The Committee examined district heating schemes and made comparisons with alternative methods of heat distribution and came to the following conclusions: (1) That district heating is a practicable method of improving the utilisation of fuel and has considerable merits as a method of smoke abolition and coal economy. (2) Combined with electricity supply it is likely to be economically as well as technically satisfactory in districts where the density of low temperature heat demand is exceptionally high, but compares unfavourably with the use of gas or gas and coke in those areas of normal demand which represent the greater part of British towns. (3) The interest aroused by district heating shows a desire for improved methods of fuel supply. (4) The most favourable development of district heating would be on the lines of what has been called "zonal heating," which involves central heating for blocks of buildings covering an appreciable area and in sufficiently large units to justify the raising of steam under pressure and the expansion of this steam with the production of electricity, before its use for the primary purpose of conveying heat.

36. **Smoke Abatement at Stoke-on-Trent** (Gas Times News Bull., 1945, **43**, 105). Up to 1939 rapid progress was being made in the conversion of intermittent ceramic ovens using coal to continuous ovens using gas, and it is

expected that this trend will continue. On the domestic side this would result in an increased availability of smokeless fuels and thus in decreased pollution from coal fires.

37. **Hazards of Carbon Monoxide** (F. S. Rossiter, *Industr. Heating*, 1943, **10**, 1654, 1658; 1944, **11**, 66, 388, 552, 612). Hazards from carbon monoxide in industry, commercial establishments and home are discussed in this series of articles. Over a 10 year period (1926-36) 46,925 deaths from carbon monoxide have been reported in the U.S. Sources of the gas in the home, motor vehicles and industry, and need for inspection and preventive measures are discussed. Symptoms after various degrees of exposure and relation to various possible after-effects are discussed. No proof of chronic poisoning has been established. Preventive measures are outlined.

38. **Memorandum on Carbon Monoxide Poisoning** (Min. of Labour and National Service. Pubd. H.M. Stationery Office, 1945, 6d. net.). Occurrence of carbon monoxide poisoning is discussed and various accidents at blast furnaces, gas producers, coke ovens, during 1941-43 are tabulated. Recognition and treatment of poisoning and suitable preventive measures are dealt with in some detail.

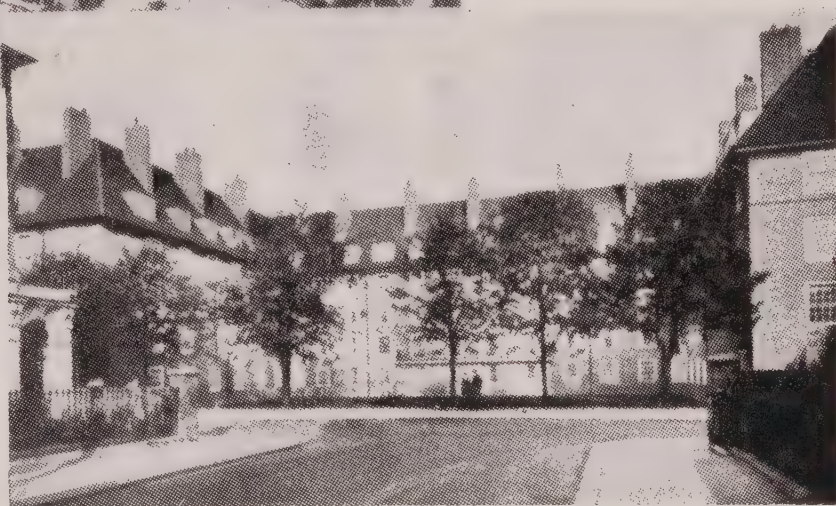
39. **Smokeless Combustion of Wood Waste** (B. H. Whitehouse, *Power Plant Engng.*, 1944, **48**, 96). The author considers the composition and formation of smoke and the conditions under which it is produced in furnaces. From an examination of the nature of luminous flames he concludes that visible smoke can be prevented by effecting the conditions necessary for complete combustion of the combustible in the smoke. The necessity for creating high velocity air currents to bring about proper mixing and for maintaining the temperature of the carbon particles above their ignition temperature, is stressed. Details are given of experiments with the use of overfire air, including the methods and results obtained. Mention is made of important factors in the proper design of furnaces for burning wood waste.



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The Prime Minister,
8th October, 1940.

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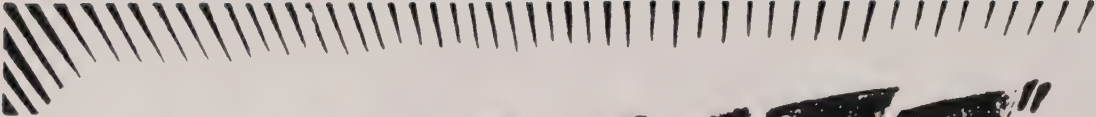
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Hon. Treasurer : Sir Lawrence Chubb

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Arnold Marsh, M.Sc.Tech., M.Inst.F.

OFFICIAL NOTICES TO MEMBERS

Executive Council Elections

The following are the results of the elections for Divisional Representatives to the new Executive Council : *Scotland*—Bailie Alex Munro, Allan Ritchie, Bailie Mrs. Lappin ; *North-West*—Charles Gandy, Dr. Metcalfe Brown, Dr. J. R. Ashworth, Dr. J. L. Burn, Dr. W. M. Frazer, Miss M. Fitzgerald, Councillor Professor F. E. Tylecote ; *North-East* : Alderman J. Cohen, Alderman P. S. Hancock ; *Yorkshire*—J. W. Beaumont, Dr. J. J. Jervis, James Law, H. Craddock ; *West-Midlands*—G. W. Farquharson, Dr. W. R. Martine, C. A. Stansbury ; *East-Midlands*—J. Gurney, A. Wade ; *South-West*—F. J. Redstone, A. Tyler ; *South-East*—H. G. Clinch, Dr. R. Lessing, J. S. Ratcliffe, Major S. F. Markham, Stewart Swift, J. J. Matthews, Mrs. H. A. Des Voeux, L. A. Stroud, R. A. Baskett, H. L. Snowden.

Annual Conference

The Society has received and accepted an invitation from the Mayor and Corporation of Brighton to hold a conference in that town in the autumn. Following are preliminary particulars. The conference will open on Thursday evening, 24th October and will end at midday on Saturday, 26th October. Meetings will be held in the Royal Pavilion, where on Friday evening the Mayor will hold a reception for members and delegates. The principal subjects to be discussed will include : (1) a regional survey of progress in the

installation of smoke preventing appliances in new houses, (2) new legislation for industrial smoke ; (3) smokeless zones and the new *Domestic Fuel Policy* Report. A preliminary programme and other information will be issued shortly. Non-members are invited to attend and to ask for information. A moderate conference fee, to defray some of the expenses, will be charged.

New Publications

Under the new constitution members and representatives may ask to receive free of charge, copies of new publications that have not been distributed generally. Current publications of this class are : (1) *Report of the October, 1945, conference on Improved Fuel Burning Appliances for New Houses* (1s.) ; (2) *Domestic Fuel Efficiency and Smoke Prevention* (report of joint conference with the Institute of Fuel, Manchester, October, 1945) (1s.) ; (3) *Smoke Control* (suggestions to local authorities in respect to new installations) (3d., 2s. 6d. per dozen) ; (4) *The Smoke Problem and Science Teaching* (a booklet for teachers, with notes and experiments) (3d., 2s. 6d. per dozen). Non-members may obtain copies at the post-free prices shown.

Smoke Problem and Science Teaching

This new booklet has been highly commended and is being offered to Education Authorities, etc., for distribution to teachers. The co-operation of local authority representatives in ensuring that this scheme receives consideration will be welcomed.

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Smokeless Air is the official organ of the Society, but the views expressed in contributed articles are not necessarily endorsed by the Society. Abstraction and quotation of matter are permitted, except where stated, provided the usual acknowledgments, including the name and address of the Society, are made.

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*Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky ;
All bright and glittering in the smokeless air.*

SMOKELESS AIR

A GREAT ADVANCE

FOR an unofficial, voluntary organization to find the most obstinate part of its programme, which it has for long patient years been developing in the face of every difficulty, adopted practically in its entirety by a Government Committee, and for the Ministry concerned at once to accept the main conclusions of the committee's report, is an uncommon and most stimulating experience. It is what has happened to the Society. The new *Domestic Fuel Policy* report of the Fuel and Power Advisory Council (H.M. Stationery Office, 1/-) recommends nearly every material point of the Society's policy for the abolition of domestic smoke, and has been approved in general by the Ministry of Fuel and Power. Smoke

prevention is of course only a part of the field it covers, but it is very clear that it has been regarded by the Advisory Council as a vitally important part.

The report appeared just as this journal was being prepared for publication. Despite the fact that five of our few pages had already been allocated to reviews of other important publications, it was necessary to scrap editorial matter already written in order to give at least a preliminary account of this last and by far the most valuable report. In our next issue we hope to discuss it in more detail. For the present we will indicate only the main recommendations that are of particular concern to us, and at the same time express our warm appreciation to the members of the Council,

and particularly to its Chairman, Sir Ernest Simon. First, they say, one of the main objectives in framing a national domestic fuel policy must be "to abolish the pollution of the atmosphere from domestic sources by soot and tar, and to reduce to the lowest practicable limits the emission of sulphurous gases." Then, "there is no solution to the smoke problem of our cities till the old-fashioned open coal grate is abolished," and: "the coal fire is sociable and pleasant, but it involves dirt and drudgery to the housewife; it wastes millions of tons of coal each year, and is the chief sinner in rendering our cities unfit for human habitation by its smoke."

On appliances for solid fuel the recommendations follow closely the representations the Society has been so persistently making. They include Government encouragement of the production of improved heating appliances for all fuels and for all domestic purposes. "It is particularly important to develop multi-fuel appliances to burn efficiently and as smokelessly as possible both bituminous coal and smokeless solid fuels . . . the manufacture and sale of new appliances falling below approved standards should be prohibited as soon as possible . . . the Government should take steps to secure the mass production of standardised domestic fuel appliances, and should make every effort to secure the installation in all new houses of approved appliances for winter space heating and water heating to burn smokeless solid fuels or to burn bituminous coal with a minimum of smoke . . . in subsidised houses the Government should consider the advisability of a free issue of such appliances as part of the subsidy . . . the old-fashioned coal grates in existing houses should be replaced wherever practicable by new approved appliances. Subsidies should be granted by the Government to encourage widespread and rapid action on these lines."

The division of load between the different fuels is considered, and recommendations made on how this should be shared between solid fuel, gas and electricity, including: "it should be the policy of the Government to replace bituminous coal in all single house appliances by solid smokeless fuel as rapidly as adequate supplies and appliances can be provided at reasonable

prices."

It is considered that if account is taken of the greater efficiency of fuel usage the bituminous coal at present used can be replaced by smokeless solid fuel entirely in 20 to 30 years. The production of smokeless fuels and a very great development in the supply of anthracite and dry steam coal should be encouraged by the Government.

There is a separate chapter on smoke abatement, and a special appendix written by Professor James Mackintosh, M.D., F.R.C.P., to which detailed reference will be made next time.

SMOKELESS ZONES

The report includes an important section on smokeless zones, of which some reference may be included with observations that had already been written on the further development of this principle. The report acknowledges the Society's part in formulating and pressing for smokeless zones, and agrees that "smoke does most harm in the large cities, and it may well be worth a special effort to clear up the atmosphere of these cities by the use of smokeless fuels and by strict control over the emission of smoke even if this leaves less smokeless fuels available for the remainder of the country." It refers to the effective action taken in St. Louis in this way and says—once more on the same lines as the Society's proposals—"when the supply of smokeless solid fuels has been substantially increased it might well be desirable to make a national plan for using the maximum proportion of smokeless solid fuels in the large cities where smoke does most damage and the declaration of large smokeless zones might be one of the best methods of securing this result." Also "one or two complete towns might consider the possibility of following the example of St. Louis; any new towns built should certainly be made smokeless from the start; one or two cities might try the experiment of declaring a selected district in the city as a smokeless zone."

It therefore recommends that "the necessary legislation should be passed to enable smokeless zones to be established, and a few such zones should be declared, mainly for experimental purposes." The powers of local authorities should include (a) power to insist

on the exclusive use of solid smokeless fuels except in approved appliances; (b) power to insist on the installation of approved appliances for central heating capable of burning bituminous coal with very little smoke emission; and (c) power to make it an offence to emit smoke."

In the light of this excellent approval, which shows a very clear understanding of the whole problem, reference may be made to the present position. The Manchester Corporation Bill, which includes provisions for the first smokeless zones in the country, is as we write beginning its passage through Parliament. We believe that these clauses will now be retained, substantially unchanged, and that we shall soon be able to congratulate Manchester on the great lead it is giving to the cause of smoke prevention. The City of London smokeless zone proposals have unfortunately had to be postponed, although in view of physical conditions in the City, the "prior approval" clauses, which it is anticipated will remain in the forthcoming Bill, will for the time being be equally valuable.

There has been, as was to be expected, some opposition to these first schemes for smokeless zones. Controversy and criticism are to be welcomed, for it is only by such means that a fuller understanding of what is intended, immediately and in the future, can be attained, not only among the general public and in industry, but among those who are actively working for smoke prevention.

Some, if not all, the criticisms of the two Bills as originally proposed, were due to the fact that they defined as smokeless zones areas in which smoke emission was prohibited. It was feared that this might permit no defence against the occasional smoke that may occur from even efficient plant, even though the amount of such smoke was negligible. The Society had sought to meet this point by reference to the Public Health Acts, defining a smokeless zone as an area in which the emission of any smoke would constitute a statutory nuisance under the terms of the Acts. This would make available a defence under the "best practicable means" clause which, it has been considered, would be just and would help to remove opposition. We are well aware that there is some danger in giving too much scope to this notorious clause, but it must be recognized that the

conditions under which it might be used would be very different from those of the past.

Whether smoke emission is flatly prohibited or dealt with as a statutory nuisance, the control to be exercised must depend on the visual observation of chimneys. Some pertinent doubts about the efficacy of this have been raised, including those contained in a paper to a meeting of the Sanitary Inspectors' Association by W. B. Kennedy of Manchester. Summarized, the argument against visual control is that whereas industrial chimneys can easily be observed, in a smokeless zone it would be extremely difficult even to see many chimneys, and in some cases to trace back the offending appliances. Observations would be limited to the daylight hours, although in many instances the plant or domestic fires would be in use during the hours of darkness. To what degree these practical difficulties will be found to be real can perhaps be answered only when we have experience of the actual working of the first zones. If it is found to work satisfactorily, well and good; if not, there is all the more reason for us to consider and press for the alternative and more and more radical form of control that can be used, which is briefly suggested in *Domestic Fuel Policy*.

This is simply to define a smokeless zone as an area in which the sale, purchase and use of bituminous coal, or such forms of coal as may be specified, are permitted only under licence for purposes approved by the local authority. Consideration of this method will at once make apparent the value of the expanding zone principle. By means of such zones we can make an immediate start in instituting "fuel control", in favourable areas, which can be expanded as rapidly and as widely as circumstances permit. In a zone so defined visual observations would be required only to check the observance of the conditions specified in licences. For open fires and other unsuitable appliances, of course, no bituminous coal licence would be considered.

More detailed examination of this further line of action is needed, and discussion in these pages will be welcomed. We invite members to send brief observations on the subject for publication in our next issue.

THE ANNUAL GENERAL MEETING

Sir George Elliston the new President

THE Society's Annual General Meeting was held on 21st March in the hall adjoining the smokeless fuels exhibition, which is described elsewhere. Over 200 members and representatives were present, which for a business meeting was surprisingly good. Mr. Gandy presided during the first part of the meeting, after which Sir George Elliston, the new President, took the chair. Before introducing Sir George, who had been returned unopposed under the new electoral rules, Mr. Gandy paid a warm tribute to the outgoing President, Mr. Will Melland. He recalled how Mr. Melland had been the inspiration of the Society in its struggling early days, both as Chairman and as Hon. Treasurer, and spoke of the affectionate gratitude we had for him regretting that ill-health prevented him at present playing an active part in our work. He suggested that Mr. Melland's name should be retained as Past President, in the list of officers, and this was approved with acclamation.

Sir George Elliston was introduced as Chairman of the Public Health Committee of the City of London Corporation, a former member of Parliament, and Editor of *The Medical Officer* (in the columns of which smoke abatement and the Society have had frequent and generous support). On taking the chair the new President gave a short address—explaining that he had been asked to deliver a more formal one at the Brighton conference in October—in which he said he was proud to become President of the Society, as he had taken a close interest in the matter of smoke abatement for nearly forty years.

The case for smoke control, he said, was now cut and dried. The outstanding item of the indictment was the deleterious effect of smoke on the health of the people. Most of our population suffered from respiratory diseases, and nearly a third died of them. We would



Sir George Elliston, M.C.

not claim that smoke was the only, or indeed the main cause of this suffering, but we could prove conclusively that it was a powerful contributory factor, and that its elimination would do more for health than all the sanitary improvements of the past forty years. It was not difficult to show that the respiratory diseases rate of towns varied directly with their smokiness, particularly with regard to young children. In fact our case might rely alone on the respiratory factor of infantile mortality, which was the easiest item on which to obtain satisfactory statistical evidence.

Sir George went on to speak of the need for equipping new houses with appliances that would make smokelessness possible. We must continue to press for the replacement of coal by smokeless fuels, such as anthracite and low volatile coals, coke, gas and electricity. And by the district piped supply of heat and hot water local

authorities in many cases should be able to give a standard of comfort in the home, the office and the workshop which had rarely been attempted before in this country and at a relatively moderate cost. He hoped that now the Government was taking over the coal industry it would be possible to plan schemes of carbonisation on a large scale that would ensure for us an abundant supply of smokeless fuels.

Sir Lawrence Chubb, who had been returned unopposed as Hon. Treasurer, presented the audited statement of accounts. He stressed the fact that although the income was rising, unavoidable new expenses in the running of the Society meant that still further efforts would be needed to give us the financial resources we needed.

The Secretary announced the results of the elections for the Executive Council, and said that this first election under the new constitution had been carried through quite satisfactorily. The percentage of ballot papers returned had been very good.

One item on the agenda was the election of Vice Presidents, now limited to 20. A member suggested that this was far too many: there should be perhaps not more than two or three. An interesting discussion on the point was ended by a resolution, unanimously approved, that the matter be considered by the new Council, which should have power to act on this occasion on behalf of the General Meeting, and should elect the number of Vice Presidents considered to be appropriate.

Aviator's Air

We reprint, slightly condensed, an editorial from "Aeronautics," which is not only most stimulating and refreshing in its general argument, but is most useful smoke prevention propaganda.

AIR transport is preparing to offer an example of the modern trend towards the circuitous, the daedal and the oblique. To-day it is the custom to do simple things in a roundabout way; in fact modern technology is largely concerned with trying to put right things that have previously been put wrong. The custom is to spoil nature by carelessness or plundering and then to employ highly elaborated scientific processes to mend it. Milk, for instance, can come clean from a healthy cow; but nowadays we prefer—or the Government is going to force us to prefer—to make the milk dirty or use a tuberculous cow and then, by the ingenious process of pasteurisation, or controlled heating, to make the milk safe again. Wheat is so treated that the vitamin content is reduced, and science comes rushing in with a means for fortifying the finished loaf that it becomes almost—but not quite—as good as the original, simple, direct, natural article.

It is now the same with the air. It is polluted with the products of the burn-

ing of bituminous coal to the confounding of air pilots and navigators and the obstruction of ultra-violet daylight. To the airman the smoke of old England is a source of annoyance, anxiety and danger. To everybody it is a source of unpleasantness and ill-health. Yet it now seems that we are going to make it possible to fly in safety over the British Isles not by keeping the air clean, but by the complicated, circuitous and oblique method of making it compulsory for all aircraft to carry radio aids. Fog flying with radar, like pasteurised milk, may eventually become as safe as the natural thing. But it will never be so appetising. Flying in clean air by direct vision is the kind of flying that is pleasurable. The right course is to keep the air clean, to abolish the smoke by providing heating and lighting systems that do not pollute the air.

If it is going to be accepted that our cities must always be smoky and dirty, and that air navigation near places like London, Manchester, Birmingham and Glasgow must be made safer by radio aids, flying must remain costly and unpleasant. Let us press for the simple direct approach. Let us forget in the marvels of radar for a moment and let us ask for old-fashioned, clean aviator's air.

Good Heating

The Solid Smokeless Fuel Exhibition

WE sincerely congratulate the Solid Smokeless Fuels Federation, and all the firms that displayed their new appliances, on an exhibition that was exactly what was needed. So much has been said about the excellent new domestic appliances for solid fuels that from all sides had grown a demand to see them, and particularly to see them working. In normal times such an exhibition would have been a fairly easy enterprise, but the familiar difficulties of the day, and the fact that many of the appliances are only just coming into production, made the job a strenuous one. How well it was done was evident to all who had the opportunity of seeing the exhibition, which, under the name of "Good Heating for Every Home," was held in the Royal Horticultural Society's Hall in Westminster from March 13th to 30th. It may be of interest to recall that a smoke abatement exhibition, under the auspices of the Coal Smoke Abatement Society and the Royal Sanitary Institute, was held in the same hall in 1905, at which one of the features was the display of 24 "improved" open grates tested by the Society.

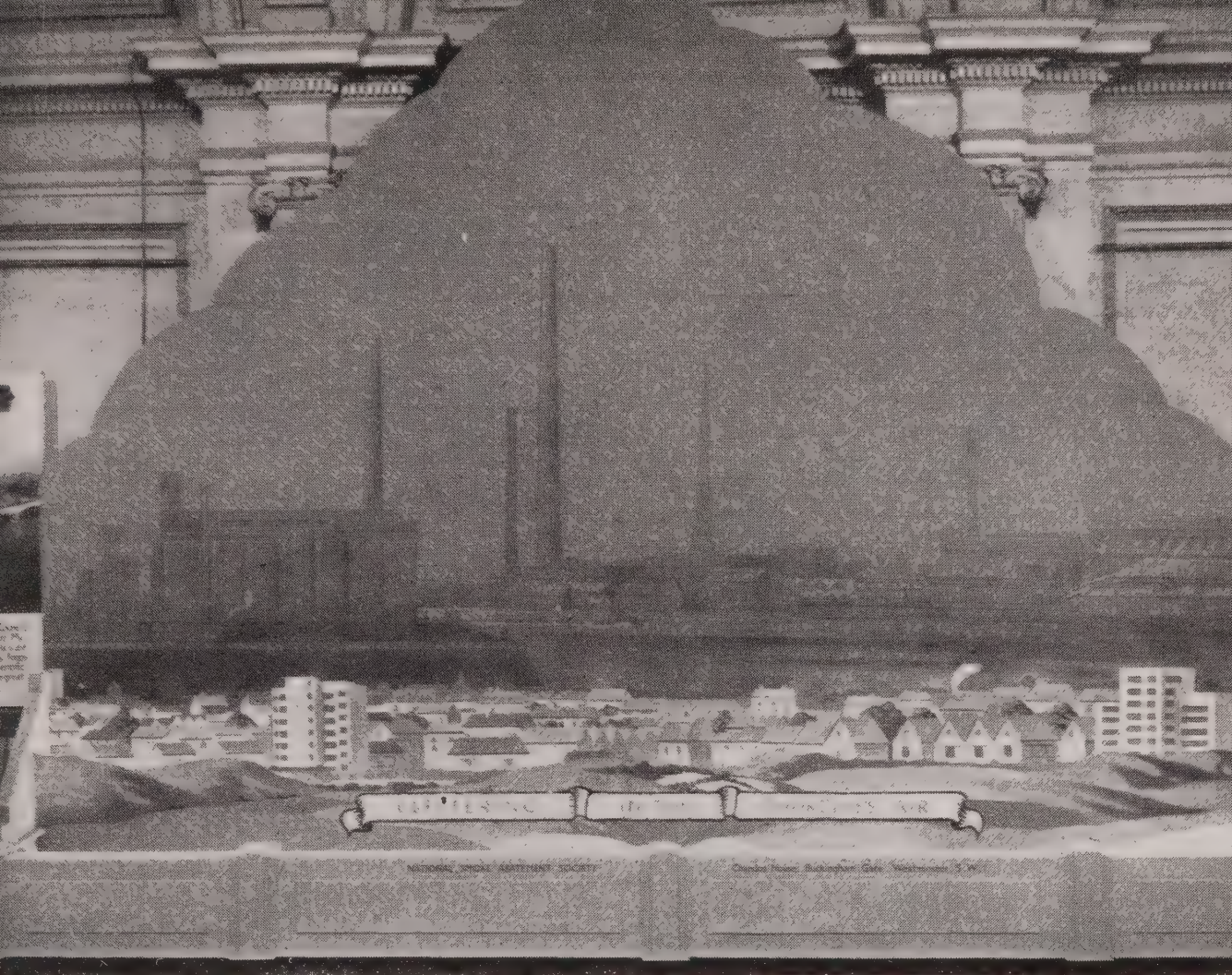
The Federation comprises the National Federation of Gas Coke Associations, the British Coking Industry Association and the South Wales Anthracite and Dry Coal Committee. The Exhibition was designed primarily not to draw the general public but to interest and give essential information to architects, builders, local authority members and officers, and, in short, to all concerned with housing. From the contacts and inquiries made at the Society's own stand we can say that it was most successful in attracting the right people, in addition to good numbers of general visitors.

It was, to begin with, a highly attractive show in its layout and design. Mr. Ian Jeffcott, F.R.I.B.A., designer for the Olympia "Ideal Homes" exhibitions, was in charge of this aspect and did it conspicuously well. It was all most satisfying to look at. In the central line of stands were appliances in

use, using on different days the different types of smokeless fuel with which the exhibition was concerned—anthracite, Welsh smokeless coals, "Phurnacite," gas coke and oven coke. (One would like to have seen low temperature carbonisation fuels there as well). The flue gases from these appliances passed into a duct, which in one section had glass walls, so that visitors could see for themselves the absence of smoke. Other appliances, not in use, stood alongside the centre section—cookers, open fires, stoves of different types, and boilers. There was an industrial section, showing central heating and other boilers for smokeless fuels, and a very useful exhibit, prepared by the Building Research Station, on insulation. The different fuels were displayed, with information about the purposes for which each size was most suitable. The by-products of carbonisation, with examples of the materials produced from them, was a further section of general interest. Accessories, a well-designed fuel store for the ordinary house, thermostatic equipment, the testing of appliances, and one of the new heat service units or towers, were other exhibits that helped to make a remarkably comprehensive display.

Smoke Prevention Well Stressed

The question of smoke prevention was well brought out on the scientific side by stands equipped by the Fuel Research Board—the measurement of smoke in the chimney and the apparatus used in the investigation of pollution in the air—and by the N.S.A.S. The Society's stand included a large decorative back-cloth of a smokeless town—"glittering in the smokeless air"—flanked by two pictorial panels. One of these was a striking enlargement of a photograph of the new Waterloo Bridge, with Mr. Herbert Morrison's appeal, "Keep it White!" and references to his speech at the opening ceremony, when he called for a "great anti-smoke campaign." The second panel showed in attractive diagrammatic form how a smokeless town could be attained by



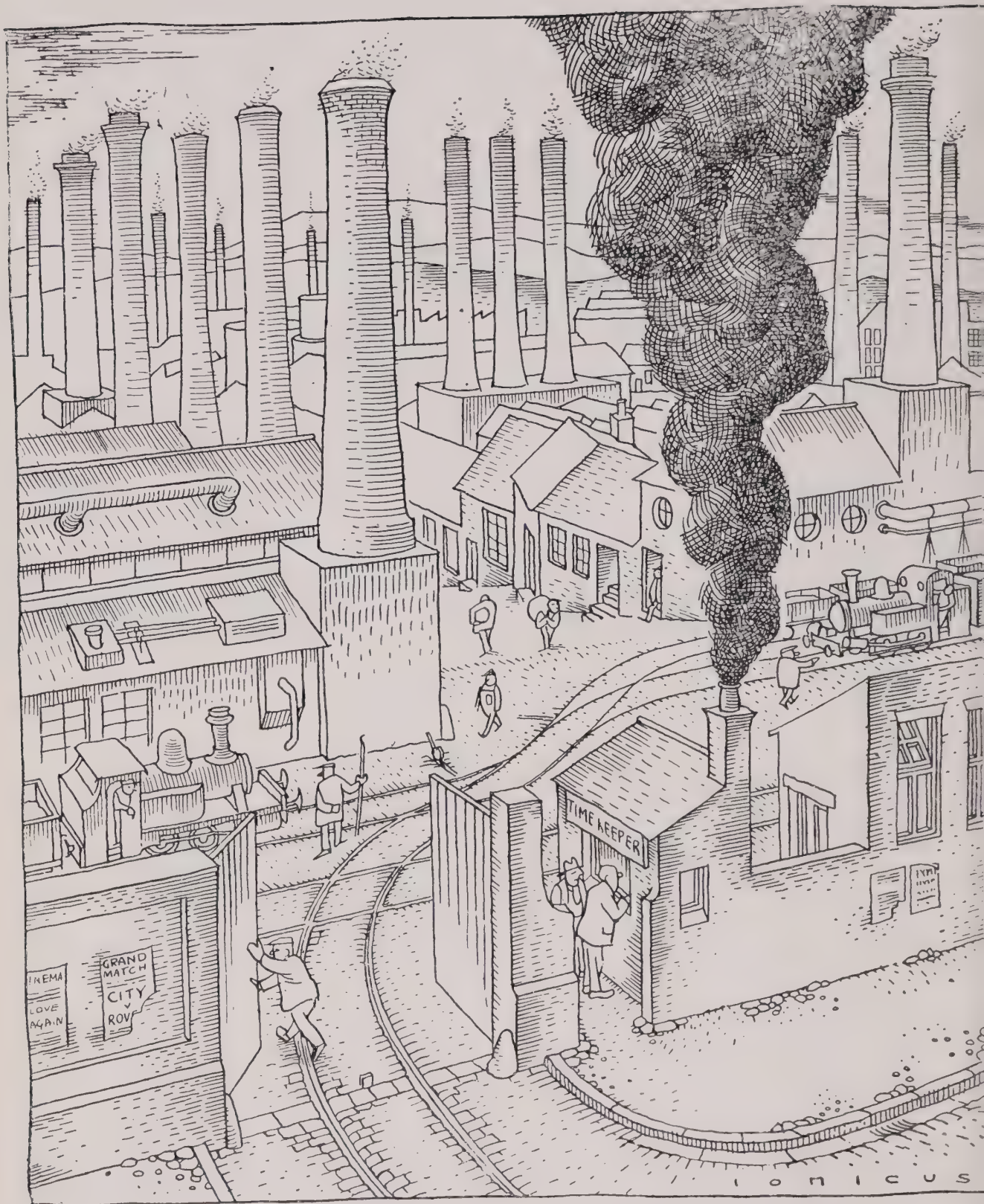
The central section of the Society's stand at the "Good Heating for Every Home" Exhibition

means of progressive zones—"Smokeless Zone to Smokeless Town" was the caption. A bookstall formed part of the stand, which displayed all the Society's publications. Sales were good.

It is not possible to refer in a necessarily short report to the individual appliances, or to the many features of importance, many of them new, they revealed. All were suitable for smokeless fuels, and many were "multi-fuel," so that there need be no hesitation about putting them into new houses while it may still be necessary to burn coal. The exhibition showed more clearly than anything else has so far done the remarkable advances that has been made since 1939 in the efficiency and the convenience and attractiveness of appearance of solid fuel-burning appliances. Credit for this must be given in full to the manufacturers, to the technical men of the backrooms and to the alert and progressive smokeless fuel industries. And, perhaps, some

credit for the advance may be claimed in respect of the way in which smoke prevention has been demanded, persistently and methodically, in recent years. It is not sufficiently recognised that developments of the kind demonstrated at this exhibition are prompted in the first place by social needs, and that it has been the part of the smoke abatement movement to help to crystallise and express the needs of to-morrow in the better utilisation of fuel.

Sulphur Trouble in Westminster (Municipal J., 23rd Nov., 1945). Local authorities are much concerned at the delay in reinstating sulphur removal at Battersea Power station. The Electricity Commissioners state that the suspension of gas washing necessitated structural alterations in the plant which must be reconverted to allow of the re-incorporation of gas washing. Full gas washing will not be in operation before September, 1947.



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News in Brief . . .

Our first page photograph this time is of a scene in Zurich, Switzerland's largest city. We have used it because Sir Ernest Simon, at a recent luncheon of the Electrical Development Association in Manchester, compared it with that city. Zurich, like Manchester, was an industrial city, with works scattered over a large part of its area. It was well planned, and the works were driven by electricity, which was also used for heating and the railways. Domestic heating was also largely smokeless. Sir Ernest put the question: "What can we do to make Manchester as pleasant and civilized a town as Zurich?" He said the smoke nuisance could be abolished in 20 years, and already gas and electricity had done something to reduce what had been called "that awful stink and choking feeling which we get when we approach the centre of Manchester on a windless winter day."

★ Smoke abatement's debt to Sir Ernest is greatly increased by the report, reviewed in these pages, for which he was largely responsible. Great strides have been made since the days when he was Hon. Secretary of the Smoke Abatement League in Manchester, *circa* 1910. ★ The Lord President of the Council, Mr. Herbert Morrison, always puts in a word for clean air when he has the opportunity. Opening the new Waterloo Bridge he said: "My appeal to London is to keep it white. It would be a great pity if it was allowed to get begrimed and dirty. Its whiteness is one of its glories. Can we keep it white in our smoky, foggy London?" He wanted to encourage the county and borough councils to carry on a scientific campaign against atmospheric pollution, a great anti-smoke campaign. ★ What we believe are the first smoke abatement cases to be taken to the courts since 1939, have recently been heard in Sheffield. Three firms were fined £2 each for causing and failing to abate a smoke nuisance. ★ Sheffield is also to have a smoke prevention clause in leases for light industrial works on land belonging to the Corporation. ★ An interesting visit was paid recently to the works and research department of one of the Society's members, the Ascot Gas Water Heater Company, Ltd. The works, rapidly reconverted from their wartime use, are now in full production

again. Especially interesting, and typical of the firm's enterprising outlook, was a "class room" well fitted with all the necessary appliances and instruments, where technicians may take a week's course in the art or craft of gas water heating. ★ Illuminating Press story dated 25th February: Fog blacked out the conference of international weather experts in London today and artificial light had to be used. The fog was smoke from the East End. An Air Ministry expert said: "The smoke cannot get away. We are having similar reports from most big industrial areas in the country." ★ The temporary houses are equipped with modern openable stoves in which smokeless fuels should be used. In normal times an educational drive or other persuasive means could be used to ensure the right fuel was in fact used, but at present of course most people are glad to take what fuel they can. Thus many of the temporary houses are using coal, and there are indications from many parts of the country that the smoke, because of the exceptionally low level at which it is emitted, is causing much more annoyance than that from an ordinary house. ★ Manchester City Council members have been debating whether hospitals in the city should be moved out into the country. Opponents of dispersal argue that if Manchester's post-war proposals of smokeless zones are vigorously pursued the air of the city will become as clear as anywhere else, and evacuation will be unnecessary. Compare this, on point of principle, with the article from *Aeronautics* on another page. ★ If we were to present in each issue a wreath of fuliginous laurel for the occasional gems of paleotechnic thought that come to our notice, the following from *The Plumber* would be a certain winner. Commenting on our Southampton conference it says: "One grows somewhat weary of the diatribes against the use of coal. After all there is something in comfort, and efficiency is not the least desideratum of civilised man . . . The coal ration is but 34 cwt. per annum, and it is indeed tragic that, of this inadequate ration, only 7 cwt. will be used effectively for heat production. Well, what about it? The comfort of a coal fire far outweighs the efficiency standard." ★ The "Ekco" people have sent us particulars of their new "Thermovent" electric convec-

tion space heater. In this a low thermal capacity element assembly is fitted into a patented system of multiple ducts, in which the air is warmed as it flows up and around the element and out through a grille into the room. The casing is of black or walnut plastic and the anodised grille is illuminated by a sign lamp. Fitted with thermostatic control for any selected temperature, the heater seems ideal and very economical for background heating. Prices are moderate. There are built-in wall models and floor models. Information from E. K. Cole, Ltd., Rembrandt House, Vigo Street, London, W.1. ★ Another successful meeting with the Institute of Fuel, this time the Yorkshire section, was held in Doncaster on 20th February. There were three technical papers—on metallurgical, general industrial, and domestic smoke—and a feature of the meeting was the co-operation with the three women's organizations concerned with gas, electricity and solid fuel. Their representatives made very useful contributions to the discussion. The

meeting was well attended by fuel people and by representatives of local authorities who had been invited by the Society. ★ In the much-publicized return of the *Golden Arrow* train on the London-Paris service, the Southern Railway was unfortunate in the use of a photograph showing the locomotive, complete with its arrow, belching black smoke in the most appalling way. The Secretary of the Society, addressing a meeting of the Associated Owners of City Properties in the City of London on the following day, was asked by the Chairman, who produced this photograph, whether the railways were not bigger sinners than the property owners! ★ This meeting, which with a lunch that followed, was most enjoyable, arose from the desire of the Property Owners to learn more about smokeless zones. It provided a most valuable opportunity of explaining the principle, and of showing how heavily the property owner pays for the smoke. He should in fact regard the Society as his best friend.

THE ROYAL SANITARY INSTITUTE

Prize Competitions in 1946

HENRY SAXON SNELL PRIZE of FIFTY GUINEAS

for essay describing suggested improvements in the construction or adaptation of sanitary appliances.

JOHN EDWARD WORTH PRIZE of £40 0 0

for an essay on practical improvements of appliances or inventions used or proposed to be used in or about dwelling houses.

JOHN S. OWENS PRIZE of £25 0 0

for an essay on either atmospheric pollution or the ventilation of dwellings and its effect upon human health.

Full particulars of the competitions can be obtained from

THE ROYAL SANITARY INSTITUTE
90 BUCKINGHAM PALACE ROAD, LONDON, S.W.1

REGIONAL COMMITTEE NEWS

The activities of the Regional Smoke Abatement Committees of local authorities which were mostly suspended during the war, are now being revived. We are therefore resuming—in a condensed form—the former regular reports of news of their progress.

Greater London Advisory Council.

—The Council has been intermittently active since 1943, but is now planning a general resumption of its work. A visit was paid in February by members of the Executive Committee to the Fuel Research Station at Greenwich. Mr. E. H. Bennett of the West Ham Housing Department has been appointed Hon. Secretary in place of Mr. Arnold Marsh, who has felt obliged to resign because of the greatly increased work of the National Society. Mr. Marsh has been elected as Hon. Consultant Secretary to the Council. Communications should now be addressed to Mr. Bennett at 383, High Street, Stratford, London, E.15.

Midlands Joint Advisory Council.

—Dr. W. R. Martine, the Hon. Secretary (Council House, Birmingham) reports that a special general meeting was held in December, 1945, to revive in full the Council's activities. 55 representatives of local authorities attended. A resolution was passed calling on the N.S.A.S. to make representations to the Minister of Health to expedite the production of new model grates for new houses, and urging all Members of Parliament in the area to support the National Society's efforts. Visits to works of interest are being encouraged. The Council has become an Institution Member of the Society.

Manchester and District.—Steps are being taken to resume the work of this Committee, and a very satisfactory response has been received to an inquiry about membership addressed to the local authorities in the area. So far 62 authorities have agreed to join as against 6 refusals. Dr. C. Metcalfe Brown, Medical Officer of Health for Manchester, is acting as Hon. Secretary (Public Health Department, Town Hall, Manchester, 2.).

Bristol and District.—A first meeting since 1939 was held in Bristol last year, at which Mr. F. J. Redstone, Chief Sanitary Inspector, City of Bristol, (48 Queen Square, Bristol, 1) was elected Hon. Secretary. A discussion on immediate problems, particularly those of new housing, was opened by Mr. Arnold Marsh.

Sheffield, Rotherham and District.

—This remains the only statutory committee, and is actively engaged in its principal work of smoke control under the Public Health Act, 1936. Atmospheric pollution measurements at a number of stations are continuing, and new work in this field is projected. The Chief Smoke Inspector is Mr. James Law, Town Hall, Sheffield.

West Riding of Yorkshire.

—This Committee has maintained its activity throughout the war, as reported from time to time in these pages. The Hon. Secretary is Dr. J. Johnstone Jervis, Public Health Department, 12 Market Buildings, Vicar Lane, Leeds, 1.

As far as is known, the West Lancashire and Cheshire, and the Northumberland and Durham Committees have not yet resumed activity.

POSTERS

Attention is drawn to the Posters the Society can supply for exhibitions, show rooms, meetings, schools, etc. A set of six, prepared for the former E.M.B. frames is still available, as is the prize design from the competition held just before the war. The first of a series of pictorial charts, prepared especially for school use, is now available, with the title, "These are the Things that Smoke Does." The price is 6d. for each poster, although for schools and similar purposes it may be agreed to supply copies free of charge.

Inquiries about posters and other publicity and educational services are welcomed.

Brighton Conference—the Minister of Health has given a general sanction for the payment of the expenses, by the local authorities concerned, of two delegates one of whom should be an officer concerned with smoke abatement work.

District Heating Digest

CENTRAL heating for larger houses and blocks of flats is recommended. The merits of district heating in assisting smoke abatement are recognised, but "there are many complex economic problems involved, and it is uncertain how far they are practicable under the conditions of this country. A sub-committee of the Egerton committee is studying the whole question of district heating, including combined thermal and electric schemes, and their report must be awaited before action can be recommended in this matter."—*From the Domestic Fuel Policy Report of the Fuel and Power Advisory Council.*

* * *

In the House of Commons, 12th April, 1946 :

Mr. Bossom asked the Minister of Fuel and Power how many local authorities have made, or are making, arrangements to set up district heating ; and what steps he is taking to encourage more local authorities to adopt district heating at the earliest possible opportunity in order to save fuel.

Mr. Shinwell : I have set up, in conjunction with my right hon. Friends the Ministers of Health and Works, a committee on domestic heating problems, with a sub-committee of technical representatives of the interested Ministries, to consider district heating generally, and, in particular, specific schemes proposed by local authorities. One local authority scheme has been submitted so far, and has been given provisional approval. A number of other local authorities are known to be considering district heating. I am anxious to give every help possible and I shall be glad to know of any schemes which are under consideration, and which may not have come to my notice, and to arrange for any technical officers to advise on them.

* * *

Among recent papers on the subject has been one by D. V. H. Smith to the Institute of Fuel under the title *Individual and District Heating Systems ; Cost Technique and Planning*. This contains a close comparison of costs that would

be difficult to summarize, but reference may be made to Mr. Smith's views on the question of thermal versus thermal-electric systems. He said :

Stress has been laid on purely thermal stations, and the query will no doubt be raised as to the combined generation of heat and electricity. In the author's view, that is of entirely secondary importance, and in the case of large existing stations it is a Utopian policy which is not worth pursuing. There is certainly a case for retention of the smaller stations, which otherwise will be discarded by the C.E.B., and utilizing these mainly as heat producing stations wherever they are favourably situated. The existing electrical plant would no doubt be of use for topping up the electric supply in peak periods.

Elsewhere in his paper Mr. Smith says : I would again stress the point that I do not advocate the entire elimination of open fires. Some sources of radiant heat is desirable, but if the bulk of the heat is obtained from a district heating system, say, enough to keep a house dry and just warm enough for normal activities, leaving the occupants to "top up" the supply of heat in the evening by gas, electricity or an open fire as desired, district heating need not be regarded as a competitor of other methods. It will simply supply background heat cheaply, and enable the existing services of gas or electricity to get all the extra load they can cope with, and charge a really economic figure for it.

* * *

While hot water or steam can provide background heating and domestic hot water supply, a system depending upon these agencies must be supplemented by another system or systems capable of producing a high-temperature radiant source of heat, and of providing heat for cooking and for bringing small quantities of water rapidly to the boil. It is therefore of the greatest importance, in considering district heating schemes, to view them in conjunction with the supplementing service or services, as the cost of these is materially affected by the extent and nature of the duties required of them. As an example of

this effect it may be pointed out that the Electricity Industry looks to the water-heating load to improve its load factor and thereby reduce the average cost of current, but this possibility is removed completely if hot water is supplied by a district heating scheme.

This interplay of one system of centralized heat supply upon the costs and successful operation of alternative or supplementary systems is the most important feature to be considered in

the development of any system. If it should be disregarded or faultily interpreted the development of centralized supply as a whole is likely to become excessively costly, its use restricted, and the public left with no reasonable alternative to the unsatisfactory methods that have been condemned by opinion from many sections of the community. —*From the First Report of the District Heating Committee, Institution of Gas Engineers.*

QUESTIONS IN COMMONS

On 4th April, 1946 ;

Mr. Keeling asked the Minister of Health at what rate the production of modern grates, suitable for all forms of solid fuel, is increasing ; and how soon it will be possible to carry out the recommendations of the Housing Manual and of the Fuel and Power Advisory Council that such grates be installed in all new houses in order to save fuel and reduce smoke.

Mr. Bevan : The production of modern grates is increasing and I will have further particulars sent to the hon. Member. Encouragement is being given to manufacturers to produce the modern type of stove, but future output will depend on the supply of labour which can be attracted into iron foundries producing this type of equipment.

Mr. Keeling : Will the Minister consider, either now or later, making the payment of subsidies for new houses conditional on installations to improve grates, in view of the great importance of this matter ?

Mr. Bevan : Local authorities have been informed that only certain types of equipment will be available ; therefore, they are designing houses with that in mind.

Captain Crookshank : Would the Minister say what he means by "Encouragement is being given to manufacturers" ? In what form is it being given ?

Mr. Bevan : By granting orders.

On 9th April, 1946 :

Mr. Keeling asked the Minister of Fuel and Power what steps he is taking to provide sufficient smokeless solid fuel, to give effect to the recommendation of the Fuel and Power Advisory Council, that such fuel should replace

bituminous coal in domestic use as rapidly as appliances for burning it are available.

Mr. Bossom asked the Minister of Fuel and Power what steps he proposes to take with regard to the recommendations contained in the report by the Fuel and Power Advisory Council with regard to smoke abatement.

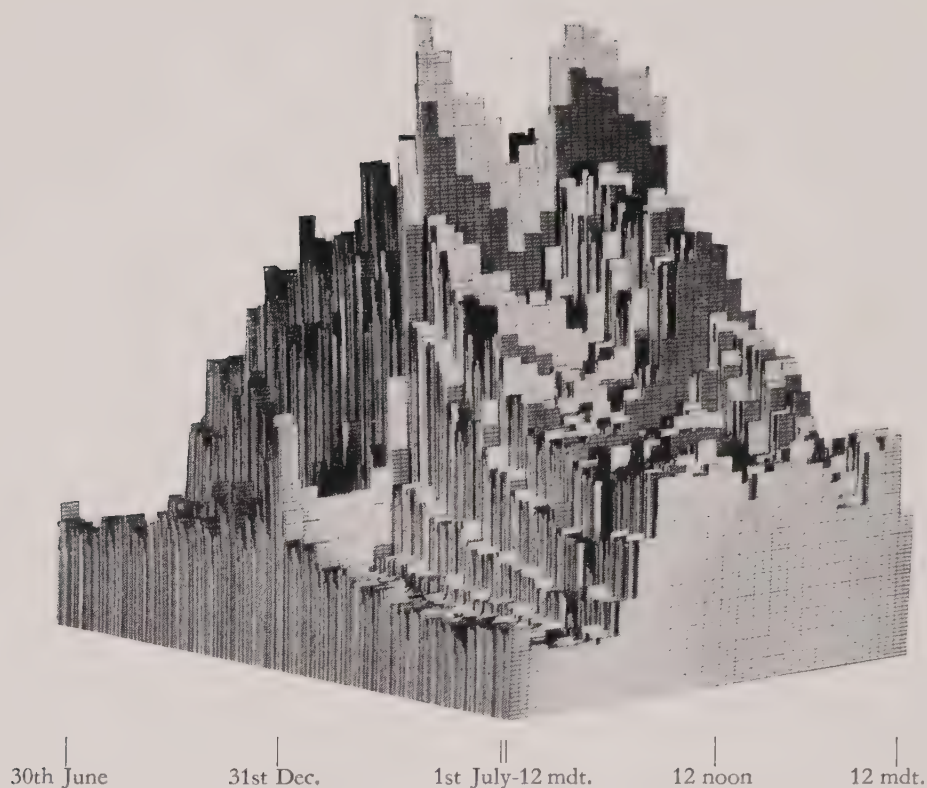
Mr. Shinwell : In conjunction with my right hon. Friends the Ministers of Health and Works I have set up an Inter-departmental Official Committee to consider and make recommendations upon the action required to implement the recommendations made in the report of the Fuel and Power Advisory Council. As far as increasing the supplies of solid smokeless fuel are concerned, I must point out that all possible steps are being taken to increase the production of all types of fuels, including smokeless fuels. The hon. Member will realize, however, that this problem is linked with that of the major reorganisation of the industry which is to take place when the National Coal Board has been set up.

Mr. Keeling : Will the Minister say whether, in order both to save coal and to reduce smoke, he is in favour of these recommendations being carried out, if they can be carried out ?

Mr. Shinwell : Yes, Sir, to a very large extent.

Mr. Bossom : Is the Minister aware that if these recommendations are carried out they will be of considerable benefit to health, an economy by saving in cleaning and a great economy in the use of fuel ?

Mr. Shinwell : I fully agree with the hon. Member. It is merely a question of securing the necessary appliances.



A MODEL OF ELECTRICITY SUPPLY LOAD

IT is thought that many readers, both technical and lay, will be interested in the three-dimensional figure illustrated. This is a "load model" of an electricity supply system during a particular year of operation. It is a graphical analysis of the collective load and is built up from the separate daily load curves for each day of the year. It clearly shows the considerable variations that have to be met, while making it clearly evident that the capacity of the system has to be such that it can meet the peak demands, even though these occur for short periods only during a few days of the year. From this the economic factors that enter into the cost of electricity can be readily appreciated, and it will be seen how advantageous it would be to even out the peak and valleys of the "off-peak" loads such as by, for example, water heating during the midnight to 6 a.m. period. Conversely, it is obvious that difficulties and increased costs would follow any unplanned, haphazard demand that merely accentuated the peaks.

The illustration is reproduced from a report "Analysis of the Load on a Modern Electricity Supply System," by kind permission of the British Electrical and Allied Industries Research Association, who have also loaned the block.

Smoke in Glasgow

In a section dealing with air purification and smoke abatement, the Annual Report for 1944, of the Medical Officer of Health for Glasgow states that the anti-smoke complex that had been developed among the plant operators in the city has, during the war years, been largely lost and, when there is a return to anything like normal conditions in this field, very great effort will have to be devoted to the work to regain the attitude of mind which has been lost.

Speaking in Cheltenham, Mr. John Roberts said, "In London alone, at least 70,000 tons of carbon black is sent into the atmosphere every year in the form of soot. The value is at least £40 per ton, so that you get some idea of what is wasted through the use of raw coal."

Reviews

THE LEICESTER SURVEY

THE report of the Atmospheric Pollution Research Committee on the special survey carried out at Leicester just before the war has at last been published (*Atmospheric Pollution in Leicester*, Department of Scientific and Industrial Research, H.M. Stationery Office, 3s.). The report is very detailed, and while some of its findings are new and of practical importance or scientific interest, others help to confirm what can be deduced from other data. The purpose of the investigation, in brief, was to obtain a better understanding of the causes of atmospheric pollution and what happens to it after it has been emitted into the air. Observations of different kinds at a number of points in and around Leicester were carried out, and the results are considered under the main headings of variation of pollution with position and variation with time. To quote the preface, the results show that atmospheric turbulence, by carrying down clean air from above and carrying up smoke-laden air from the street level, is the most important agent in preventing the accumulation of dirt in the air of our towns. Once the smoke has been carried up to the height of a few hundreds, or thousands of feet, it is carried away and distributed over the country around.

Of the pollution measured in central Leicester, from 10 to 40 per cent. originates outside the city; the actual percentage depending on wind direction and the time of year. At a point four miles east of Leicester, in west winds, the pollution from the city, in arbitrary units, amounts to 15; pollution from the Birmingham district (30 to 40 miles upwind), 10 units; and completely exotic and very local pollution, 20 units. This influence of distant pollution on country districts in relation to the effects of pollution (particularly by reduction of light intensity) on agricultural productivity, is a matter of importance not yet fully

appreciated.

The figures given for the variations of pollution in summer and winter, weekdays and Sundays, are of interest. They show that the population of the inner and outer suburbs, whether at work or leisure, makes about twice as much smoke in proportion to the coal burnt as the population near central Leicester. A guide to combustion efficiency is suggested by the fact that when there is less smoke produced for a given weight of coal the proportion of sulphur dioxide in the measured pollution is increased.

It is to the chapter on "Practical Aspects" that those concerned with the prevention of smoke will turn with some expectancy. This will be increased by the introductory statement that "smokeless zones are compared, somewhat to their disadvantage, with other types of reform." It is therefore most disappointing to find a practically complete absence of any suggestions of practical value for promoting reform, and certainly no alternative to the smokeless zone principle. It is suggested that unavoidable pollution might be emitted only under turbulent atmospheric conditions (i.e., when the sun is high and in clear windy weather typified by cumulous clouds), but this can, of course, be only a rare and doubtful expedient. The statement that "the problem of reducing smoke in large cities below a stipulated value can best be solved by drastic reforms in methods of burning raw coal, particularly in the home," would have been of value if it had continued by saying how. Again, to suggest that "the effect of town acreage and population on smoke concentration" is "one of the matters which authorities should face when they are planning new towns or new satellites of towns" is an alarming symptom of defeatism. Town planning on a basis of new smoke production would be a negation of proper planning. One of the essentials of a plan worthy of the

name must be smoke prevention. (For the right approach see the review of the Manchester Plan which follows).

Smokeless Zones

The report's criticism of smokeless zones is based on a complete misconception of what a smokeless zone is, supported by some scientifically doubtful experiments. A smokeless zone is considered merely as what is in fact only its initial stage—i.e., the most suitable starting point, normally the central area, in a town. The purpose of smokeless zones is that they can expand, link up with other zones, and finally cover the whole country. The central area of Manchester may be a beginning, but the United Kingdom is the final objective. To argue that the initial zones might not show much improvement in conditions because of the diffusion of pollution from contiguous areas, is to miss the point completely. Smokeless zones would still be the most practical method for progressive smoke prevention even if the nuclei showed no improvement whatever.

On the basis of this error the Committee conducted experiments in Hyde Park which showed that the pollution there was less than it was around the Park. "The average reduction in pollution to be expected at the centre of a square mile free from smoke emission," the report concludes, "is 25 to 30 per cent., but in different weather conditions the reduction may be anything from 15 to 75 per cent. There is also appreciably less pollution in the adjoining districts. Reductions of less than 50 to 75 per cent. would probably be insufficient to impress the average citizen. The introduction of small smokeless zones is therefore unlikely to bring about a great increase in the

popular demand for purer air, unless the improvements are measured accurately and the results made public."

Contrary to the opinion of the report, which seems anxious to praise smoke prevention with faint damns, these figures are not at all unsatisfactory for a starting point. They are certainly of more use than the new-born baby of Faraday's classical retort about electricity. Whether they are accurate or not is, however, rather doubtful. To begin with, Hyde Park is not a smokeless zone in the practical meaning of the term. A smokeless zone is a built-up area which, unless it is a new one, was before its reform contributing to the pollution of its own atmosphere as well as to that of the surrounding area. The improvement to be experienced after its conversion will not be measured by the difference between its new degree of pollution and the pollution outside, now reduced, but between the old and the new pollution *within* the zone. Further, since Hyde Park is an empty space it makes no artificial contribution to turbulence. A built-up area consists of heated buildings, chimneys emitting streams of warm gases, buildings and gaps between buildings and streets, all of which will tend to promote turbulence. It may well be that these factors would make no significant difference, but they at least suggest that the Hyde Park figures are open to question.

It is regretted, though it is not surprising, that this one unfortunate excursion into the practical problems of smoke prevention made in the report should have been seized on by the opponents of smoke prevention measures as evidence against smokeless zones. The academic attitude is not always the most helpful.

HEATING AND VENTILATION

In *Heating and Ventilation of Dwellings* (Department of Scientific and Industrial Research, H.M. Stationery Office, 2/6) we have the most comprehensive and up-to-date survey of a hitherto neglected field of investigation and planning. The report is that of the Heating and Ventilation (Reconstruction) Committee of the Building Research Board, of which Sir Alfred Egerton was Chairman. It is impossible in the restricted space

available to review the many important facts and views in the principal sections of the report, which deal with the basic requirements for heat, the amount of heat needed in dwellings, and the choice of methods. It is also impracticable to discuss the interesting Heating of Dwellings Inquiry of the War-time Social Survey, included in the volume, in which by numerous questions to a cross section of the population much

valuable information on needs, desires and prejudices was obtained. (Although mention may be made, in view of the 'open coal fire myth, that 34 per cent. of 5,187 answers to a question about central heating were favourable). On the general aspects of the report we can, at the moment, say only that it should without fail be closely studied by everyone concerned in any capacity with housing.

Here we must restrict attention to the chapter on "The Importance of Amenities," which includes atmospheric pollution, and its ancillary question of saving labour in the home; and in particular to the more detailed appendix on atmospheric pollution. This is a condensed but comprehensive survey of the principal effects of pollution, its sources, distribution, cost, and what is called its "mitigation." Of particular value are the estimates of the amount of pollution from coal as used in various ways. The table showing the total pollution produced annually from the various sources and fuels, in production and in use, is a most useful, and reasonably accurate, analysis.

Referring to the Leicester Survey and the evidence for the spreading of smoke over considerable distances it is stated: "The inference is clearly that atmospheric pollution is more than a local or even a regional problem, but a national one. A single community, be it town or city, cannot obtain for itself a truly clean atmosphere, since it is at the mercy of other communities, some of which may be quite remote from it. This does not mean that no benefit will come from the abatement of local pollution. The high local concentration of pollution in an urban centre before its own smoke becomes disseminated is, of course, far worse than the widely distributed general pollution." Then follows a reference to smokeless zones, which is a little more to the point than in the Leicester report, in that it says a smokeless zone would not reap the whole benefit of reduction in emission of pollution *if* the surrounding conditions remain unchanged.

The one section of this examination of the smoke problem we should most like to consider at length, and rather critically, is that on the cost of smoke, but here, too, observations must be brief. Based largely on the Pittsburgh and Manchester inquiry figures, it is

estimated that "the more tangible" effects of pollution are approximately £26.2 millions a year. The .2 in an "approximation" of "more tangible" items is statistically absurd, especially as the report continues: "there is reason to believe that the final cost in the country would be not less than twice the above figure." It could in point of fact be argued that there is reason, if not hard figures, for believing that it may be five or ten times as great.

The report then assumes a total cost of £45 millions a year, or roughly 20s. per head, and an attempt is made to assess this according to the damage done by smoke and by sulphur dioxide. £21 millions are debited to smoke, £20 millions to sulphur dioxide, and £4 millions to loss due to unburned coal. This is interesting, but seems to be based on more guesswork than is usually found in a Government report. Also interesting, but equally doubtful, is an analysis of the cost of pollution from various fuels, in which, to give an example, it is stated that with coke smoke costs 1½d. per ton burned, and sulphur dioxide 2s. 7d. a ton, making 2s. 8½d. in all. The domestic coal fire costs 8s. 1d. per ton, and so on. With the data on which all smoke-cost estimates must necessarily be based it seems to be extraordinarily temerarious to give the cost of pollution due to coke down to the last halfpenny! It is certainly going much further than the National Smoke Abatement Society, with wisdom born of experience, would dare to venture.

One important correction which has not been considered in these estimates is that of the present level of prices. Any figures derived from the Pittsburgh (1912) or Manchester (1920) inquiries must be increased to something like double if they are to bear a correct relationship to conditions to-day. A further point that might be queried is whether there is any reality in the division of cost into that due to smoke and that due to sulphur dioxide? Are the effects of general pollution (smoke plus sulphur dioxide) equal to what the effects of the two constituents would be separately, or is it not probable that they are substantially greater? To what extent, for instance, is the corrosion due to sulphur dioxide increased if it is associated with an adhesive deposit?

And if vegetation is injured both by acids and by loss of light, is the total injury the sum of the two separate injuries or may it not be greater? Such questions have not yet been satisfactorily investigated.

In spite of these minor criticisms it is most useful to the smoke abatement movement to have the problem discussed so fully, and generally so admirably, in an authoritative Government document.

MANCHESTER AND SMOKE ABOLITION

It is outside our province to attempt to review the *City of Manchester Plan* as a whole, although it is not possible to refrain from expressing admiration at the breadth of vision and bold, yet practical courage that it displays. It is a great pleasure, too, to handle once again a volume so well printed and with such a wealth of illustrations and maps. The City Surveyor and Engineer, R. Nicholas, has set forth the plan in a manner worthy of the subject.

He is especially to be congratulated, in these pages, on the chapter entitled, without any ambiguity, "The Abolition of Smoke." This begins:

"Atmospheric pollution is the greatest single enemy of the city-dweller's health; it is always present, injuring our lungs and obstructing the health-giving rays of the sun.

"A great city like Manchester could, and should, be a pleasing place in which to live and work. It ought not to be necessary for its citizens to seek refuge from a perpetual pall of dirty smoke by getting as far away from the city centre as their economic circumstances permit. No planning scheme for Manchester would be complete unless it included measures for putting an end to the pollution of the atmosphere by domestic and industrial smoke."

It is shown how the effects of smoke are intensified in Manchester by its geographical position, which tends to promote cloud and fog formation. The effects of pollution are reviewed, and reference is made to one of the Society's photographs, which is reproduced, showing the progressive blackening of buildings in King Street. "Continuous association with such squalid surroundings," it is said, "dulls the sense of beauty and leads one to accept an ugly environment as normal."

Then follows a section on what has been done, which is followed by a

series of practical proposals of what should be done.

"Real progress towards the complete elimination of smoke throughout the city can be achieved only by a resolute and systematic application of the following measures:

"(1) The improvement of industrial boilers and of auxiliary plant for washing fuels and flue gases.

"(2) The extension of the use of gas and electricity wherever practicable.

"(3) Such an improvement of domestic appliances for burning solid fuel that smokeless fuels become more economical and convenient to use than bituminous coal.

"(4) The installation of district heating in new and redeveloped residential and industrial areas, so that the use of coal may be confined to a small number of central plants which can be made to burn it smokelessly and with the highest possible efficiency.

"The first three are useful palliatives, capable of immediate application; the last will take time, but constitutes the only radical remedy for atmospheric pollution."

These factors are discussed in detail that shows a full and clear appreciation of the problem. The emphasis placed on district heating as the only radical remedy is based on findings of a recent inquiry into this particular form of public utility service. It is difficult either to endorse or to criticise the unqualified view that this is the only radical remedy without going into the whole of the complex district heating question. Provided, however, that the impetus for the abolition of smoke which is demanded is duly applied the question of the degree to which district heating, or alternative methods, con-

tribute to the final solution, is of secondary importance.

The chapter concludes as firmly as it began, and usefully refers to the need for a statutory board for the whole area. To quote again :

“The provision of well-planned houses and parks will not produce healthy living conditions if the sun is still excluded and the air still fouled by smoke and fumes ; nor will new buildings be pleasing, whatever their lay-out and design, if their walls are soon begrimed.

“The ultimate elimination of atmospheric pollution must be a prime objective in all post-war plans for the city. It is attainable, but it cannot be achieved rapidly. It must be a gradual process, marching with the physical redevelopment programme. The immediate aim should be to make the remaining development of Wythenshawe smokeless and to eliminate smoke from

the inner areas of redevelopment, whether residential, commercial or industrial. Further, the installation of smokeless fuel-burning appliances should be encouraged by every possible means in premises not yet due for redevelopment, and effected in existing municipal houses as soon as is practicable.

“A statutory regional smoke abatement board, preferably with the same administrative boundaries as the South Lancashire and North Cheshire advisory planning area, must become a reality in the post-war period. The formation of such a board would ensure the uniform application of smoke abatement measures. Our ultimate objective must be to render the whole region free from atmospheric pollution, for only when this is accomplished can Manchester enjoy that clear sky which would revolutionize the character of our urban life.”

STOKER'S MANUAL

The Fuel Efficiency Committee of the Ministry of Fuel and Power is to be congratulated on *The Stoker's Manual* (H.M.S.O., 6d.). It should be in the hands of every stoker and boiler attendant in the country. Its clear, straight-forward text and numerous diagrams explain the principles of good furnace stoking in a practical and easily-followed manner. It is surprising how much varied information is included, without abstruse detail, in the eighty odd pages of the booklet. Furnace efficiency and fuel-saving are, of course, the key-notes, and stress is laid not only on “how” to do things, but “why” they should be done.

The Manual is in full harmony with the work that has been done by the smoke abatement movement for industrial smoke prevention through better stoking and will be invaluable for those taking part in classes. In this case smoke abatement is naturally not the theme or motive, but all the same it is implicit throughout. One direct refer-

ence is brief and to the point :

“An efficient furnace does not make black smoke. Black smoke issuing from the top of a chimney is an indication of incomplete combustion. Although even dense black smoke may not contain more sooty material than amounts to a loss of 1 per cent. of the coal, it must be recognized that combustible gases such as carbon monoxide usually accompany it and make the loss serious. In addition there is loss due to the fouling of the heating surfaces of the boilers and economisers, etc., by the soot which is a very good insulator and hinders the transfer of heat through the plates or tubes to the water.

“The causes of black smoke are : (a) lack of air ; (b) lack of mixture of air and volatiles above the firebed ; (c) lack of temperature ; and (d) lack of combustion space. A light haze at the chimney top is an indication of efficient combustion. It is very helpful if the chimney top can be seen from the firing floor, if necessary by the use of mirrors.”



Brighton Conference

Book the date: **OCTOBER 24-26**



SMOKE PREVENTION

ABSTRACTS

Acknowledgments are made, where required, to the Abstract sources indicated.

40. **South Wales Coals** (Regional Survey of South Wales Coalfields, Min. F. & P., H.M.S.O., 4d.). The latest report on the present position and future prospects of the British coalfields contains a full statement of the situation in South Wales in regard to production, productivity, employment and various other matters, and also includes a useful and exhaustive review of the estimated reserves of the coalfield. It makes recommendations for measures that should be taken to enable the fullest use to be made of the resources.

41. **Smoke and Health**, Mills, C. A. (Rhode Island Med. J., July, 1945, **28**, 496-500, 509; J.Ind.Hyg.Tox.Abstr., Nov., 1945, **27**, 184). In both Cincinnati and Pittsburgh the incidence of pneumonia is much higher in districts with high soot-fall rates than in other districts of the cities. Both soot-fall and pneumonia rates are much higher in Pittsburgh than in Cincinnati. That other factors besides socio-economic are responsible is evidenced by the fact that in the low-lying smoky areas the pneumonia death rate for males is 35 per cent. higher than for females, while in the hilltop suburbs it is only 3 per cent. higher. Other possibilities for this difference, such as altitude and differences between males and females are ruled out by the author. Similar, but less marked, correlations exist for tuberculosis and respiratory tract cancer. "Doubtless a similar situation would be found for sinusitis, bronchitis, and other minor respiratory diseases if reliable statistics were available." Exhaust steam from power sources adds greatly to the winter smoke problem by remaining as a fog to hold the flue products suspended in the air. Remedial steps should include: (a) Use of low-volatile coal, or proper equipment to burn high-volatile varieties smokelessly; (b) effective trapping of fly-ash in chimney or stack; (c) preliminary washing of high-sulphur coals; and (d) use by the railroads of diesel or electric power within metropolitan limits.

42. **Multi-cyclone Dust Collectors** (Elect. Times, 13th Dec., 1945, **108**, 768-70. Fuel Abstr. Dec., 1945). New designs of cyclone collectors are being

installed in power stations in Britain which are claimed to give results comparable with those of electrostatic precipitators. Reduction in the cyclone diameter has led to a tubular collector consisting of a large number of very small cyclones, each built up of two tubes, 6 ins. and 4½ ins. being the standard diameters. The efficiency is over 90 per cent. for dust from stoker fired boilers and between 80 and 90 per cent. with pulverized fuel dust depending on the size of the dust. The duplex design incorporates a secondary collector of a high efficiency type which deals with very fine dust and raises the total efficiency to 95 per cent.

43. **District Heating**, Association for Planning and Regional Reconstruction (London: The Association Review No. 4, Nov., 1944, 58 pp.). A discussion of the methods and costs of district heating, with arguments for and against it.

44. **Industrial Uses of Oil** (House of Commons Report, 8th April, 1946). On the motion for the adjournment Mr. F. J. Errol urged the greater use of oil as an industrial fuel, instancing the saving of manpower in boiler plant operation, and suggesting that it would pay financially to import fuel oil and export the coal so saved. The Minister of Fuel and Power replied, stating that the use of oil for industrial purposes would be encouraged, particularly in view of the continuing shortage of coal.

45. **South Wales Gas Grid**, David, E. I. (add. to S. Wales Inst. of Engs., Gas J., 19th Dec., 1945, **246**, 882; W. D. Abstr.). The speaker referred to the proposed gas grid for South Wales and to the large amount of surplus blast furnace gas which, among other uses, was suitable, after treatment, for providing a controlled atmosphere for annealing furnaces. He gave much statistical information and indicated that if the present coke ovens were rebuilt as combination ovens, heated by producer gas, sufficient coke-oven gas would be available for the anticipated requirements of South Wales gas undertakings in the next decade.



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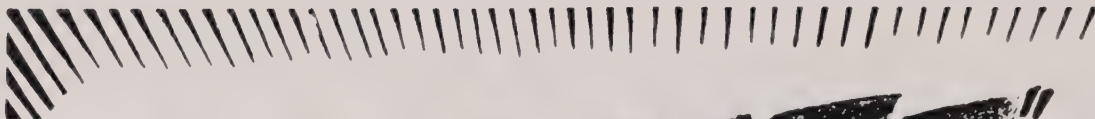
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OFFICIAL NOTICES TO MEMBERS

Vice-Presidents

At the Annual General Meeting it was resolved that for this year the election of Vice-Presidents be made by the Council. The following have been elected :

Viscount Cecil, the Lord Bishop of Birmingham, Lord Horder, Sir Ernest Simon, Sir Charles Reilly, Dr. R. Veitch Clark, Dr. Julian Huxley, Dr. Johnstone Jervis, Dr. R. H. H. Jolly, Dr. H. Osborne, Dr. Violet Robertson, Dr. E. W. Smith, A. C. Bossom, M.P., E. H. Keeling, M.P., William B. Smith.

Special General Meeting

A Special General Meeting, of which notice has been sent to Members and Representatives of Members, has been called for 24th October, at Brighton, for the purpose of considering an amendment to the Constitution to be moved on behalf of the Council. The object of the amendment is to place the election of Vice-Presidents on the same basis as that of President and Hon. Treasurer; namely, that nominations shall be made six weeks before an Annual General Meeting and that if necessary a ballot by post shall be held.

New Publication

Under the constitution members who request a copy may receive free of charge a new pamphlet, *Industrial Smoke Prevention*, being preliminary proposals made by the Council for new legislation for the control of industrial

smoke by prior approval and registration of installations, etc. Price to non-members, 3d.

Recent Publications

Other publications similarly available on request, with post-free price to non-members, are : (1) *Report of the October, 1945, conference on Improved Fuel Burning Appliances for New Houses*; (2) *Domestic Fuel Efficiency and Smoke Prevention* (report of joint conference with the Institute of Fuel, Manchester, October, 1945) (1s.); (3) *Smoke Control* (suggestions to local authorities in respect to new installations) (3d., 2s. 6d. per dozen); (4) *The Smoke Problem and Science Teaching* (booklet for teachers, with notes and experiments) (3d., 2s. 6d. per dozen).

Forthcoming Meetings

Arrangements are being made for joint meetings with the Institute of Fuel, North Western Section, to be held in Liverpool on 28th November, 1946, and in Manchester on 5th March, 1947. Full details will be sent on request.

North West Division

A provisional Divisional Council for the North West Division was elected at a meeting of members of the Division in Manchester on 18th July. The meeting, in the Town Hall, was welcomed by the Lord Mayor of Manchester. The first meeting of the Divisional Council elected the following officers : *Chairman* : Alderman Halstead (Bolton); *Vice-Chairman* : Professor F. E. Tylecote, M.D. (Manchester); *Hon. Treasurer* : Mrs. L. Hayhurst; *Hon. Secretary* : H. Moore (Public Health Department, Town Hall, Manchester).

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SMOKELESS AIR

PRESENT DISCONTENTS

ALTHOUGH the smoke abatement movement is feeling unusually pleased on account of the signs of progress to be made in the future, there is less reason for satisfaction if the present position, and the conditions likely to be experienced during the next year or two, are examined. On the industrial side there appears to be a substantial increase in emissions that rank as nuisances, from both smoke in its restricted sense and from grit and ash. For the home no progress towards the greater use of smokeless fuels, in place of raw coal, is possible; if anything there are homes once smokeless in which the use of raw coal has once again had to be accepted.

The reasons for all this are not difficult to find. Above all the desperate shortage of coal means that much of low quality, uncleaned and often of unsuitable size, is having to be accepted and used in both industry and the home.

In the factory this often means smoke where there would otherwise be a clear chimney, and overloading demanding increased draught and hence grit emission. Much is being done, through the Fuel Efficiency department of the Ministry of Fuel and Power, to prevent waste and improve efficiency, but from the very nature of the situation it is impossible to recommend what is often the correct remedy for improving output, reducing cost, and eliminating smoke—changing to a better quality fuel. It would be idle to complain of this situation until coal supplies are more abundant and are once again adequately cleaned, graded and classified. Unfortunately, it is only too likely that the coal shortage will persist for some years, and little prospect of early relief can be seen.

It is more promising to anticipate that it will become easier to improve many of the industrial installations in which

coal is burned. There has been little renewal of plant, and only urgent extensions, during the war years. There should now be more and more opportunity for putting plant in good order, extending it where necessary, or, best of all in some cases, scrapping it and starting anew. Nevertheless, it will take some time to make up all the leeway, and ills due to plant deficiencies cannot be cured everywhere at once. And then there is trouble due to inexperienced or careless stoking, or to a good man being obliged to divert some of his attention to other tasks. This too is an aftermath of the war, and demands all possible energy being put into courses of training and certification of stokers. The Ministry of Fuel and Power, with its publicity, films, Stokers' and Furnacemen's Manuals, is doing very good work, and it is encouraging that new training and examinations schemes, on a national basis and covering the hitherto most elementary grade, are being discussed and will be promoted under the wings of the Ministry and the City and Guilds of London Institute.

The Society receives many complaints and requests for advice or assistance in smoke nuisance cases. At present it is very difficult to be really helpful. Legal action under the Public Health Act is less useful to-day than ever before, when so often one knows that the root of the trouble is the quality of fuel. It must not be forgotten, however, that in some cases the difficulties that have been mentioned here are not the true ones—the reduction of smoke can often be achieved if the will to do it is there. The congenital smoke-maker may look on fuel and other topical problems as excellent excuses for evading his responsibilities.

The Ministry's policy of conversion of coal-burning industrial plant to oil as a way of releasing coal for other purposes should help to reduce smoke, provided that the oil-burners are correctly adjusted and intelligently used. Oil is an excellent smokeless fuel *if* it is carefully used, and it cannot be guilty of either sulphur or ash emission. But if it is not burned in the proper manner it can create a very dense black smoke—of which some flagrant examples exist. The behaviour of the new installations will be watched with interest.

Rationing Anomalies

The present domestic fuel situation is equally intractable and shows little hope of an early improvement. The policies advocated by the Society and now backed by the Fuel and Power Advisory Council cannot be applied until there is a vastly increased production of the new appliances and of smokeless fuels, and a full opportunity given to those who want to install new gas, electric and solid fuel appliances. At present, and perhaps even more during the coming winter than last year, we are all glad to secure what fuel we can. One of the unfortunate aspects of domestic fuel restrictions or rationing is the additional difficulty placed in the way of those who wish to have smokeless fuels instead of raw coal, either because of the nature of their grates, or on principle. Although "Coalite" is in the same class as house coal other smokeless fuels are not, and to obtain them a special application must be made to the local Fuel Officer. Some applicants may be fortunate; others, one knows, have much trouble with misunderstandings, queries, and always the possibility of a boiler fuel arriving instead of an open grate size. In one case brought to our notice it was stated that the applicant was informed that she could have smokeless fuel in place of coal, but only half the quantity would be allowed. This appears to be an entirely unwarranted ruling, and altogether the procedure appears to be unduly arbitrary, cumbersome and needless. There may be reasons for its retention, but they cannot be substantial, and a free choice of fuel in Class I is not likely to make any material difference to the general supply situation. We should be glad to have reports from any members who may have had difficulties in securing smokeless fuel as an alternative to coal. We cannot expect the long-term policy for the progressive substitution of raw coal by smokeless fuel to be launched in present circumstances, but it does appear to be making a bad start actively to discourage the beginnings of that change.

Temporary Houses

One of the most unfortunate results of the fuel shortage is that the first houses to be equipped with new ap-

pliances — the openable stoves — in which smokeless fuel should always be used, are the temporary homes. In most of these, apparently, bituminous coal is being burned, and, as houses are single storey, smoke is given off at a low level and is causing many complaints. Surely an effort could be made to supply smokeless fuels to these homes. The correct use of the stoves is also not always understood and difficulties in manipulation have caused dissatisfaction. Such troubles have occurred in Salford, among other places, and the Public Health Department here has acted in an admirable way by issuing an explanatory leaflet to the occupiers of temporary houses, and has in addition made arrangements for supplies of smokeless fuel to be available. Dr. Burn, the Medical Officer of Health, would no doubt be glad to let those interested have a copy of his helpful leaflet.

The list of our present discontents

could be extended, but must be ended by a reference to the recrudescence of smoke and fumes from burning colliery spoilbanks. These were successfully extinguished during the war as an essential precaution against air attack, but now that strict control over them can no longer be enforced they are, in certain instances, again causing trouble. The responsibility is that of the local authority for the area concerned, and it is up to them to take suitable action as soon as it is called for. Or, more logically, *before* it is called for.

For our frontispiece *Smokeless Air* photograph this time we have an unexpected view of a town in the Lancashire smoke-belt—Bolton. It was, of course, taken during the holiday week, when most household fires and industrial furnaces were temporarily extinguished.

R. H. CLAYTON

By the death, on August 12th, at the age of 74, of Robert Henry Clayton, of Manchester, the Society has lost one of its oldest, most active, and most warmly esteemed members. Until recently a member of the Executive Committee, Mr. Clayton's interest in smoke abatement dated back to at least 1909, when his Chairman's Address to the Manchester Section of the Society of Chemical Industry had the unusual title of "The Conservation of Finished Products." It was a novel and outspoken examination of the smoke problem and the economic waste for which it was responsible. Mr. Clayton always emphasised the guilt of the domestic chimney and was especially interested in education for smoke abatement in the schools. He was the first to offer prizes to schools for essays on the subject, and members may recall the prize-winning essay from the Manchester High School for Girls we published last year.

Mr. Clayton was a Director of the associated companies of Hardman and Holden, Ltd., and the Manchester Oxide Co., Ltd., and was also a Director of Cortonwood Collieries, Ltd. His early training, and B.Sc. degree in chemistry, had been gained at Owens

College, University of Manchester, and after graduating he spent a considerable time in Germany. His particular technical interest was the dry cleaning of coal gas, and he was a member of the Institution of Gas Engineers and of the Coke Oven Managers' Association.

He had wide educational and scientific interests, and was closely concerned with the affairs of his University, being a member of the Court of Governors and Past-Chairman of Convocation. He was an active member of the Manchester Literary Philosophical Society, its Treasurer for many years, and President from 1937-39.

The many members of the Society who knew Mr. Clayton will greatly miss him from our gatherings. His quiet, almost diffident manner, unfailing kindness and friendly dry humour, perhaps at first tended to hide his deep and sincere determination to help in every way the cause of smoke abatement. With our Past President Will Melland, he was a staunch friend when the Smoke Abatement League in Manchester was struggling to find its feet, and his helpfulness continued throughout, unaffected by his many other interests or by the advancing years.

“Time of Challenge and of Opportunity”

We print below excerpts of views and comments of a number of members on future policy—smokeless zones, fuel control, and the new position arising from the Domestic Fuel Policy Report. Further short letters on these topics will be welcomed.

What Can Be Done

THE present is a time of challenge and of opportunity to all concerned to get a smokeless Britain—whether individuals, groups, local authorities or Government Departments. It is a time of challenge because our acute shortages of smokeless fuels and appliances to use them make real enterprise necessary, and a time of opportunity because now, with reconstruction only beginning, is the chance for bold and forward-looking plans.

What can be done?

The local authorities, as guardians of amenity and public health in their areas can seek powers to establish future smokeless zones and to control the heating equipment of new premises; as the principal house builders, these days, they can see that their houses are equipped for warmth, economy and smokelessness—there is no conflict between these ends.

The Government Departments can help by assisting the local authorities to get statutory powers for smokeless zones and the control of new installations, and by sponsoring the production of the right fuel equipment—efficient, economical and smokeless—for the new houses. This latter function cannot be overstressed. With the best will in the world, local authorities cannot build for smokelessness if they cannot get the right equipment. The key to that lies in the Government's hands—a programme for the mass production and bulk purchase of the equipment, just as was done for our war needs. This equipment could be issued direct to the

local authorities as a subsidy in kind. There need be no nett cost to the Government, since large subsidies are to be given in any case. To give part in kind thus would bring economies in production, and warmth, fuel saving and smokelessness for the user.

Where do the individuals and groups come in? Clearly, to prompt the local authorities and the Government Departments to do these things; to make Councillors and M.P.'s alike realize that this indeed is a tide to be taken at the flood, or missed to our enduring loss.

John Patrick.

Licensing Bituminous Coal

Experience alone can prove whether the control of the use of fuel in defined areas or in smokeless zones can successfully be achieved. Statements have been made in certain quarters that the coal available to us would not permit a complete prohibition of the use of raw bituminous coal throughout the country. On the other hand, according to reports of a speech made by him in the House of Commons, Mr. E. Shinwell (Minister of Fuel and Power) appears to have no doubt as to the practicability of such a step.

In my view, therefore, the declaration of smokeless zones by *selected* local authorities is the best procedure at this stage. It would be advantageous if some were given legal power to prevent the emission of smoke in defined areas and others were authorized legally to declare zones in which the sale, purchase and use of bituminous coal would only be permitted under licence granted

by the local authorities. Experience thus gained in the course of a few years would enable us to determine which procedure is the more satisfactory and would give us the evidence upon which we could ask Parliament to pass appropriate legislation applicable to the whole country.—*A. Wade (Chief Sanitary Inspector, City of Nottingham).*

Slow Haste with Publicity

While I am in full agreement with the proposal to try out experimental smokeless zones in one or two of our large cities, I think we shall have to be very careful, in view of the findings in the *Leicester Survey*, in the handling of smokeless zone publicity.

There may be a real danger of leading the citizens in the selected cities to expect too much too rapidly, and if they find after a year or so that there is no very perceptible diminution in the volume of smoke in the zone, their enthusiasm may wane for a considerable period. I recommend a policy of hasten-slowly on the publicity side.

I am also in agreement with the proposal that local authorities should be given the power to control the installation of approved fuel equipment, provided that the approval of the equipment is vested in an impartial, scientific official body, either national or regional in its scope. I would suggest that in the first place this official body should list all fuel equipment which is capable of burning smokeless fuels and make this list available to all cities and towns as they obtain powers of approval.—*Leslie Hardern (Public Relations Officer, Gas, Light and Coke Company).*

The Battle Not Over

To those of us who have taken a special interest in smoke abatement over a period of years, it is most gratifying to find the views we have so often expressed now accepted and recommended by the Fuel and Power Advisory Committee and approved in general by the Minister of Fuel and Power. In our newfound joy, however, we must not think that the battle is over. The antiquated and wasteful method of heating rooms by open coal fires has certainly been judged and roundly condemned, but there will still be much educational work required to convince local authorities, builders and others of this fact and to urge them to adopt the

use of more modern appliances. To encourage them to do so it will be necessary for the Government to arrange with manufacturers for the production of a greater number of those appliances than are at present available.

It is interesting to observe that the Report supports the views of the Society regarding the formation of smokeless zones. That this suggestion is practicable has already been demonstrated in Edinburgh. Prior to the war, the central zone of the city comprising the Princes Street-George Street area, had actually become a smokeless zone by the action taken by the local authority with the goodwill and co-operation of the owners and occupiers of premises in that area. Unfortunately, owing to the coal situation, that achievement has been somewhat spoilt, but it is hoped only temporarily. The idea was to extend the clearing up process by the addition of further zones to this central area.—*Allan W. Ritchie (President, Scottish Division; Chief Sanitary Inspector, City of Edinburgh).*

A Political Panel

The *Domestic Fuel Policy* report is perfectly clear that in recommending the establishment of smokeless zones—at first mainly for experimental purposes—the object is to secure effective smokelessness. There is no ambiguity, consequently the most effective methods of ensuring this are required, including fuel control and the use only of approved appliances. Under these conditions smoke emission will be virtually impossible, and the Society would be justified in urging that local authorities should be empowered to make it an offence to emit smoke.

This Report must not be shelved, and the Society should immediately adopt the suggestion made by Dr. G. E. Foxwell at the London Conference, 1943, of setting up a Political Panel. (See page 16 of the report of that conference.)—*Herbert Craddock.*

Best Practicable Means

The news that there is now strong probability of smokeless zones being established in some of our more progressive cities will greatly encourage those who believe that the last great unchecked environmental health menace for which a remedy is known, is atmospheric pollution by smoke.

The "best practicable means" clause in legislation would be fatal to any attempt to eradicate smoke. At all costs this must be avoided. It would be better at first to limit requirements to the prohibition of the use of smoke-producing fuel unless consumed in approved smoke-reducing appliances, with a right of entry for inspection on evidence of any smoke emission from any chimney in the area.—*Dr. E. D. Irvine (Medical Officer of Health, Shipley, U.D.C.)*

Horse before Cart?

The St. Louis scheme has much to commend it, for I feel that we have for some time now been inclined to "bark up the wrong tree." There are, inevitably, domestic living rooms and the traditional love of the open firegrate. There is also an acute shortage of the necessary solid smokeless fuels without which the more up-to-date firegrates cannot be rendered even relatively smokeless. Think of the smoke pall over our prefabricated houses to-day; yet the grates installed are of the no-smoke order.

Let us have the horse before the cart in this, and let us press for the right types of fuel as the important step towards perfection to-day. Then with the help of the up-to-date firegrate, we may succeed in establishing the truly smokeless zone. Smoke consciousness is extending: our voice is now being heard where we want it to be heard. Smokeless fuels, then smokeless firegrates, then smokeless zones.—*Dr. W. R. Martine (Assistant Medical Officer of Health, City of Birmingham; Hon. Secretary, Midlands Joint Advisory Council for Smoke Abatement)*.

Semi-Smokeless Zones

Smokeless Zones. What do these words imply? Do we envisage areas in all towns where it will be illegal to discharge any smoke from any fuel-burning appliances, thus truly smokeless zones; or areas in which the smoke output from all chimneys, both industrial and domestic, is controlled by an Act operating on the lines of our present Public Health Act, thus creating semi-smokeless zones?

Districts free of all smoke emissions would be ideal, but as these are only likely in a few specially selected small areas, which already produce little

smoke, would it not be better to devote our energies to the creation of large semi-smokeless zones in all towns and cities?

To cover action against factory and trade premises chimneys, the main smoke sections of the Public Health Act, and byelaws, could be retained in a somewhat altered form, so as to speed up procedure. Smoke indicators and alarms are now made by half-a-dozen firms and boiler and furnace users should take steps to observe their own smoke emissions. In the case of excessive black smoke discharge it should not be necessary to serve abatement notices and then wait for a repeat of the offence before instituting legal proceedings. Power should be given to a qualified inspector to commence immediate court proceedings without waiting to refer the matter to a distant committee meeting, thereby causing delay and usually permitting more smoke emission.

All other chimneys might be included in additional sections, or a separate Act, in which it would be unlawful (a) to emit any smoke from the chimneys of any fuel-burning apparatus; or (b) to use other than smokeless fuel in any open type fireplace, with powers to inspect both fuel and fires used—*Ernest Clegg*.

Simple Social Progress

One of the greatest blots on our civilization has been the pollution of the air caused by modern industrial processes. The damage to health and well-being is incalculable and the grime-encrusted condition of many of our noblest buildings is visible evidence of the effect of smoke pollution.

One of the first tasks of fuel technologists is to eliminate this menace, but this cannot be done without the fullest co-operation of the public. This implies legislation and I welcome the Parliamentary measures for smokeless zones in certain of our large cities. When these nuclei have been established, as I have no doubt they will be, it will be a matter of simple social progress to extend them until the community can enjoy the benefits of a clean atmosphere.

The Gas Industry is in full accord with these ideals and will co-operate wholeheartedly in their fulfilment.—*The President, Institution of Gas Engineers*.

Fuel Control Procedure

No zone can be made smokeless if the control of such a zone is based only on the application of the Public Health Acts, 1936, dealing with smoke nuisance. Approval of existing and future bituminous coal burning furnaces or grates is required, and also the control of the type of fuel to be used. We can visualize the future type of zones will be mainly central areas, *i.e.*, commercial and comparatively small in acreage; therefore such approval and control of fuel shows great possibilities if at the same time the right of the individual owners to burn the type of fuel which they desire is also recognized.

The fuel control could be arranged by the serving of a legal letter in the form of a notice on the owner of the installation specifying the type of fuel that should be used. The owner would then apply to the Fuel Officer or Overseer of the district for a licence to enable his coal merchant to supply the type of fuel specified.

This is similar to the system now practised on application for a building licence or materials on essential work, which is required to be carried out under statutory notice by the local authority. Therefore, assuming good liaison between the departments of the Ministry of Fuel and Power and the Local Authority no great difficulties should be experienced.—*George W. Farquharson, Senior Smoke and Factories Inspector, City of Birmingham.*

Zones Must be Smokeless in Fact

Of the recommendations of the Fuel and Power Advisory Council the most arresting and original, from such an authoritative source, is the one which advocates that where subsidized houses are concerned, the Government should make the use of approved solid fuel appliances a condition of subsidy and should consider the advisability of a free issue of such appliances as part of the subsidy. It may be remembered that at a conference of the N.S.A.S. in London on 5th November, 1943, I ventured to suggest that in the interest of public health the Government should give financial assistance to those who, by carrying out necessary improvements and alterations, cease to pollute the atmosphere by the emission of coal smoke, in the same manner as

they now authorize a local authority, under Section 47 of the Public Health Act, 1936, to pay part of the cost of conversion of closets to the water carriage system.

All the appendices to the Report are excellent, in particular those contributed by Professor Mackintosh. His references to New York, Chicago and St. Louis could appropriately be grouped under the heading "Smokeless Zones." Although the regulations in force in these places are, of course, far in advance of any action yet taken in this country, one wonders whether it would not be a mistake for us to agree to the burning of bituminous coal in any circumstances, in smokeless zones. It is agreed that available supplies of smokeless fuels are not large enough to meet requirements in the event of a 100 per cent change-over from coal. The process of evolution is slow, however, and it is reasonable to suppose that the supply of alternative smokeless fuels to replace bituminous coal would keep pace with any demand likely to be made. As far as is possible, we should ensure that any smokeless zones agreed upon are indeed smokeless in fact and not only in name.—*John W. Beaumont, Deputy Chairman, Executive Council, N.S.A.S.*

Atomic Energy

The report of the Fuel and Power Advisory Council provides, *inter alia*, a most encouraging official endorsement of the Society's aims. If only half the legislation proposed in the report were put into hand with the speed now shown in passing measures of a more controversial character the appearance of our large towns and the health of their citizens would rapidly be improved.

The economics of District Heating are being examined by a special committee, but such schemes are difficult to justify due to the large capital expenditure involved which is not fully used during the summer or night time. The success of the combined thermal electric scheme is dependent on a high electrical load factor which under the present trend in respect of factory working hours is not likely to be maintained.

The Council do not mention the possibility of using atomic fission which naturally affects the long-term fuel policy mentioned in the report. Some scientists expect that this will be con-

trolled sufficiently to produce heat for electric power station boilers in about five years. If this be so the solid fuel problem may well be solved by using electricity exclusively for all domestic purposes and there will be no need to carry out the large programme of construction envisaged to respect of coal carbonization plants as it will only be necessary to see that electric mains of sufficient capacity are provided during the interim period and to make sure that generating plant is available when required.—*R. G. Gamlen (District Manager, Mid-Cumberland Electricity Co., Ltd.)*.

Call it a Crime!

I think that perhaps one of the greatest benefits to be hoped for from the setting up of smokeless zones will be the establishing of the fact that pollution of the air is a crime. Many worthy citizens feel vaguely that it is

desirable that there should be no coal smoke in the air, but they lack a sense of personal responsibility in the matter. Doctors and others, even members of the N.S.A.S. go on burning soft coal in open grates in their own houses, local authorities and their officials allow the same practice in buildings under their control without, apparently, any sense of guilt.

This moral blindness is due to the fact that, while gross pollution of the atmosphere has been a legal offence, slight pollution has not, and the dividing line between the two has not been clearly drawn. If we have smokeless zones any discharge of coal smoke into the air will be recognized for what it is, and even if the zones are small they may produce effects far beyond their boundaries by raising ethical standards.—*Dr. Henry MacWilliam, (Walton Hospital, Liverpool)*.

REGIONAL AND DIVISIONAL NEWS

Manchester and District Regional Committee

At a meeting held in Manchester on 18th June, 78 representatives of 48 local authorities were welcomed by the Lord Mayor and Lady Mayoress of Manchester. Councillor T. M. Larrad, Chairman of the Manchester Public Health Committee, was elected Chairman of the Regional Committee, and Alderman S. T. Marron, Mayor of Oldham, elected Deputy Chairman. Dr. C. Metcalfe Brown, Medical Officer of Health for Manchester, was appointed Honorary Secretary.

An Executive Committee was appointed, comprising members from Bury, Manchester, Oldham, Cheshire County Council, Stalybridge, Prestwick, Stretford, Chadderton, Whitefield, Urmston, Bucklow R.D.C. and Runcorn R.D.C.

Out of 91 local authorities in the area of the Committee, 68 are already members, and steps are being taken to persuade the remainder to join. The Committee decided to become a Member of the National Smoke Abatement Society and to co-operate with it in a survey of fuel-burning installations in new houses in the Regional area, upon which a report would be presented at

the Society's conference in Brighton. Educational activities, future policy, and the *Domestic Fuel Policy* report of the Fuel and Power Advisory Council were discussed at the meeting.

Midlands Joint Advisory Council

A most successful meeting was held at Rowley Regis on 2nd May, when the control of dust nuisance from Tarmac and Asphalt Works was demonstrated at the morning session. After lunch a short business meeting was held, followed by a brief paper by Mr. G. W. Farquharson, followed by a lively discussion, on "Modern Trends in Smoke Abatement." 45 representatives of the constituent local authorities attended. Local authority membership has risen to 47—an increase of 5 on that for 1939.

The Executive Committee of the Council continues to assist local authorities in the eradication of problems of atmospheric pollution and, in continuance of the Council's policy of education of the public, articles by Dr. Paul (Smethwick) and Dr. Massey (Coventry) have been published in *Better Health*, and by Dr. Martine (Birmingham) in the *Health Education Journal*.

(Concluded on page 83)

Brighton

ONLY once before has the Society arranged for a conference at a seaside town, and that was to have been at Blackpool—in September, 1939. The conference at Brighton on October 24th to 26th will be the largest we have ever had—the attendance list is already near to 400—and we cannot be sure as to how much this very satisfactory figure is due to the new interest in the problem and how much to the attractions of the meeting place.

One thing is certain: the Society has never met, and is unlikely ever to meet, in more exotic surroundings than the Royal Pavilion, and especially the actual conference room, the Music, or Chinese, Room. It is unique and amazing in the exuberance and fantasy of its decoration. Designed by John Nash (who, we feel sure, must have enjoyed the unusual job immensely) for George IV when Regent, the building was erected between 1784 and 1820. Those who are to visit the Pavilion for the first time will find more than smoke abatement to interest them. As for Brighton in general—we can only say that in October, when the holiday crowds have thinned, it will be found



His Worship the Mayor of Brighton
(*Councillor Walter Clout, J.P.*)



Photo: J. Dixon-Scott

The Royal Pavilion

to be a seaside town where great popularity has not destroyed dignity and beauty, and where there remains much of a more serene and spacious age.

We are afraid, however, that except for those who come earlier or stay on afterwards, the conference programme will take up most of the time. After opening on the Thursday afternoon at 4.30 with the Presidential Address, there is to be that evening a "get together" assembly (with a film show), by invitation of the President and Council, and a reception by the Mayor of Brighton on the Friday evening. Friday morning and afternoon, and Saturday morning will be devoted to the business of the conference.

Progress in the problem of the heating installations for new houses, with ten reports from the different regions, the new "prior approval" proposals for new legislation, and future policy are the main headlines of the programme. Each topic is of first-rate importance and interest, and very full discussions are anticipated. The detailed programme is being sent only to those who are registered as attending, but other members may receive a copy for information on request. There is still time to register (the conference fee is one guinea), but application should be made at once.

Steel and Smoke

Excerpts from the paper "Technical Progress in Industrial Smoke Abatement" read at the Joint Meeting of the Society and the Yorkshire Section of the Institute of Fuel in Doncaster on 20th February, 1946

By Dr. H. A. Fells

IN 1929, the Technical Department of the National Federation of Iron and Steel Manufacturers submitted a report to the joint committee of the Sheffield Steel Manufacturers Smoke Abatement Research Committee and the local statutory Committee on Smoke Abatement, showing the progress made up to that time in smoke mitigation. In spite of evidence produced by researches on the action of gases on steels at elevated temperatures, it was still contended in the report that there were material practical advantages in having "incandescent carbonaceous matter" or smoke in the furnace, and that this smoke had influence on the type and quantity of scale formed on the steel. It was appreciated, of course, that reduction of excess air above the fuel bed was the prime factor in determining the amount of scale formed, and looking back over the progress made in the last 15 years it is nothing short of wonderful that anyone was ever coerced into believing that black smoke was a necessity. It was evident, however, in works practice, that only when coal was burned so as to avoid excess air by reducing draught and having no secondary air, especially in low temperature processes such as annealing, the correct temperature and furnace atmosphere conditions were unavoidably accompanied by smoke. This smoke was a ready indication to the fireman that his furnace conditions were right and so, to him only, black smoke was a necessity. Further researches prosecuted at Leeds by Prof. Cobb and his co-workers, and by the Sheffield Smoke Abatement Research Committee, on the action of gases present in the products of combustion of fuels on many types of steels, sup-

ported by the production and use of new types of furnace using fuels other than raw coal, finally cleared away the haze of unenlightenment on the need for black smoke, and the problem of smoke abatement showed up in its true form as being one of cost of furnaces and cost of fuel. Well-informed and willing, as fuel technologists might have been a few years ago, financial considerations and the risks of heavy capital expenditure during the years of world-wide depression in trade made it impossible to put into practice the known remedies to prevent the emission of black smoke.

Coal-fired Furnaces

Hand-fired coal furnaces have always been the *bête-noir* in the industrial smoke problem, and in my opinion, whatever changes are made in their design, they always will be. Some improvements have been made, however, in the use of hand-fired coal furnaces, but from the point of view of smoke mitigation, little if anything has been achieved.

The need for feeding coal continuously on to the grate at a uniform rate became apparent at a very early stage, especially for boiler firing, and in recent years substantial development has been made in the design and use of mechanical underfeed stokers for steel heating furnaces. The use of mechanical stokers permits greater control of the rate of combustion, automatic regulation of furnace temperature by means of simple thermostatic devices, saving in labour, and when properly installed and maintained, it is claimed that 25-30 per cent saving of fuel can be assured. Hand-fired furnaces have an efficiency of fuel usage of only 5 to 7 per cent, but with mechanical stokers efficiencies of up-

wards of 15 per cent can be attained, along with increased rates of output of steel and with some reduction in the emission of smoke.

Pulverized Fuel

It is to be expected that coal in a fine state of division could be burned more readily and efficiently than large coal, and of recent years great efforts have been made to increase the use of pulverized coal both for large boiler firing and steel furnace heating. Combustion with powdered coal is practically complete with relatively small amounts of excess air, and the opportunity to regulate the rates of flow of fuel and air has enabled very high efficiencies, of the order of 85 per cent to be obtained in large boiler practice, but with steel furnaces the high flame temperatures resulting can present difficulties. The contribution to smoke abatement made by pulverized fuel in steel furnaces is not of a high order, and what there is is offset by the difficulties introduced by the emission of grit.

Gas-fired Furnaces

The technically sound method of burning fuel is to convert it into the gaseous state, and the introduction of producer-gas was the first real step towards elimination of black smoke. Raw producer-gas made from bituminous coals in automatic producers can be subjected to flow control, pressure control and, to a limited extent, to calorific value control, and the air requirements for combustion regulation are equally controllable. Both gas and air can be preheated by waste heat salvage methods, or the sensible heat of the hot producer-gas itself may be utilised with in-built producers. Where a producer plant supplies a group of furnaces through large-size mains, the tarry vapours condense, and periodically the mains and flues become clogged with tar and soot and have to be burned out. This gives rise to heavy smoke production, but the heating of the furnace to obtain suitable temperature and atmospheric conditions can be carried out without the production of smoke.

Coke producer-gas has much to commend it from the point of view of smoke prevention. Any type of flame and furnace atmosphere conditions required for steel heating can be attained, air/gas ratio control presents little difficulty, and waste heat recovery

enables the attainment of high fuel efficiency. The principal deterrent to the extended use of coke producer-gas is the high thermal cost compared with coal or coal producer-gas, but the production of steel without the emission of smoke is assured.

Coke Oven Gas

You are all well aware of the inception and development of the South Yorkshire Gas Grid following the recommendations of the Area Gas Supply Committee in 1930, and many of you realise its intrinsic value to the steel industry and to the coke-oven industry, but I make no excuse for bringing to your notice some aspects of its contribution to the smoke problem.

Steel firms had come to appreciate the possibilities of the use of town gas in steel heating in the years following the first World War, but its use and development had been limited on the score of availability and price. With the inception of the Gas Grid, the initial consideration given to the pricing of gas for industrial heating purposes paved the way to the increasing demand we have seen in the past 15 years. A price was determined as low as 2.4d. per therm when coal was costing 0.6d. per therm and the average cost of producer gas in the area was assessed at 2.0d. per therm. This price interested the steel manufacturers, and a rapidly growing demand for coke-oven gas for industrial heating began.

(The paper gives a table showing how the industrial use of gas developed in Sheffield. In 1929, 2,416 million cubic feet of gas were used; in 1938 this had risen to 7,623 million, and in 1942 to 12,096 million. Examples of savings of coal in specific cases were quoted. In one case 1 ton of steel required 23 million B.Th.U. *using coal*, and afterwards 7½ million B.Th.U. *using gas*).

We see then that in Sheffield the gas used in 1942 did work which would have required some 630,000 tons of coal. This replacement of coal by coke-oven gas, becoming progressively bigger each year from 1929 until it reached a peak in 1942 when 630,000 tons of coal were replaced, is no mean contribution to the abolition of smoke.

Gas Furnace Development

The past decade has seen great developments in gas furnace design. The comparatively crude batch type

direct fired furnace is being replaced by furnaces embodying automatic control of temperature, automatic gas/air ratio control, furnace pressure control, waste heat recovery systems using regenerators or metallic recuperators, or load preheating chambers. Furnace loading is changing from batch-type to continuous, with either belt conveyors, pushers, walking beam, roller hearths or rotating hearths.

Mechanisation of furnaces, the development of new burner systems such as radiant tubes, radiant blocks, recuperative radiant tubes, coupled with the many systems of producing gas purges for independent atmosphere control, have made possible rates and quality of production which make our earlier ideas of fuel economy antiquated. The productivity value of gaseous fuel made possible by the researches and developments of the past few years in burner design, instrumentation and mechanization of furnaces, hot-face insulation, and forced recirculation of furnace gases, has given a new concept to the meaning of fuel economy. Not only are gas furnaces available to-day with fuel efficiencies of 50 to 60 per cent, but their design and full automatic control have made the reheating and heat-treatment of steels and non-ferrous metals a matter of scientific precision rather than a craftsman's art. I cannot let this opportunity pass without mentioning real furnace atmosphere control. Steel in the form of strip, bars, tubes, wire, sheets and slabs, can now be annealed in gas furnaces to precise temperature specifications without any surface damage whatever. Non-ferrous metals and alloys can be annealed in such a manner that they emerge from the furnace with the pristine brightness they had before entering the furnace. The saving of subsequent processes such as acid pickling, scrubbing and washing, the saving of metal, and the reduction of labour, have made the cost of both fuel and furnace almost matters of insignificance. More recently the development of what is known as "concentrated combustion" has made it possible to reduce the time of heating steel billets to rolling temperature of 1,250 deg. C. to minutes instead of hours; to anneal stainless steel tubes in seconds; to heat steel plate for shearing and piercing in seconds; and at the

same time, due to the speed of heating, to be virtually free from surface damage due to scale. All this may seem far removed from smoke abatement, but it is contended that research in problems of combustion of gaseous fuel, industrial gas burner design, applications of such burners to furnace design, control instruments for gas and air flow, waste heat recovery, thermal insulation by suitable refractories, and the mechanization of furnaces have shown that fuel, when the fuel is available as town gas (coke-oven gas) is capable of giving all that modern metallurgical processes demand.

Other Furnace Developments

The use of electric resistor elements and of induction heating for heat-treatment of metals has reached a high level already in many spheres. Electric resistor elements in a well insulated furnace structure, coupled with the ease of automatic temperature control and furnace atmosphere control by any of the many well proved gas purge systems, also allows for adequate mechanization of production, and the latest developments of electric induction heating of small parts for mass production have made speeds of production possible which would have seemed fantastic a few years ago.

Developments in the use of fuel oil for furnace heating were progressing before the war, especially for large reheating processes, and the control of its combustion again was conducive to smokeless furnace conditions.

National Aspects of Coal Utilisation

The tremendous urge to conserve the nation's coal reserves has given further impetus to projects which have been in the process of development now for many years. Research on the complete gasification of coal being carried on by the Gas Research Board; the separation of ethylene and other hydrocarbons from coke-oven gas as base products used in the preparation of plastics; the preparation of oils and chemicals by synthesis from water-gas in the Fischer-Tropsch Process; and the host of processes conveniently covered by the heading "Chemical industries based on processing raw coal," are consolidating our ideas as to how coal should be used, and gives more than a mere hope that the time is approaching when the use of raw coal as a fuel will be forbidden.

Reviews

London's Air and Natural History

IN his remarkably informative and fascinating volume **London's Natural History** (Collins, 16s.) R. S. R. Fitter has devoted a whole chapter to the influence of smoke on wild life in and around the metropolis. Although some of the material will necessarily be familiar to those who are "well up" in this aspect of the smoke problem, the author has many points that will be new to most readers. Thus the smoky air of London is believed to be responsible for the scarcity of many kinds of wild plants around the area: the infrequency of lichens on the trees in Epping Forest, for example, is attributed to this cause.

A curious and most interesting indirect effect is that of the so-called industrial melanism in moths. Certain varieties produce black or blackish variants in London and other industrial districts. This is believed to be due to a factor of natural selection. The blackish or melanic form is rather hardier than the ordinary type, but its greater conspicuousness in normal surroundings renders it an easier victim for predators. In sooty areas, however, this darkness is an advantage, making the moths less conspicuous, and this, together with their natural hardiness, has led to a considerable increase, sometimes amounting to a total replacement, of melanic types during the past fifty years or so.

Another interesting point is that in helping to reduce smoke, the large gas-works and electricity generating stations have provided oases for wild life in heavily-built-up areas. A kestrel's nest in one of the chimney shafts of the L.C.C. tramways power station at Greenwich in 1928, for example; and a considerable number of wild plants, plus rabbits and hedgehogs, and "a surprisingly large list of birds," at the Gas Light and Coke Company's works at Bromley-by-Bow at the mouth of the River Lea.

Smoke is one of the many influences of human activity on natural life described by Mr. Fitter, and those of

our readers whose interest in smoke is a part of wider interests will find the whole book well worth their study. It is one of Messrs. Collins's new series, "The New Naturalist," and for these restricted days is admirably produced and illustrated. There are over 50 colour photographs and nearly as many in black and white.

New Towns

Final Report of the New Towns Committee, Ministry of Town and Country Planning and Department of Health for Scotland (H.M.S.O., 1s. 3d.)

After the unambiguous expression of opinion in the Domestic Fuel Policy Report, that "any new towns built should certainly be made smokeless from the start," it was hoped that the New Towns Committee of the Ministry of Town and Country Planning would show without any doubt that it appreciated the need for this, and that it would recommend the full planning required for complete smokelessness. The Society had urged the case for smokelessness from the start in a memorandum submitted to the Committee.

In the Final Report there is one paragraph on the subject, and although this is satisfactory as far as it goes, it cannot be regarded as convincingly enthusiastic:

The injury to health and amenities from atmospheric pollution is now admitted and can be prevented. Building regulations should require that solid-fuel burning appliances must be of approved types when supplies are available. These have the further advantage of fuel economy. We hope that national standards for such apparatus will be prescribed. The agency's approval should be required for any new fuel burning installation other than domestic; in the U.S.A. and other countries such approval is required.

Possibly we feel a little disappointed in this because *Domestic Fuel Policy* has given us new standards of what we may now expect from Government sources. The recommendations may, however, be enough: the spirit in which they are acted upon and developed as the new towns come into being will be more important—and to urge effective action will doubtless be

one of the Society's tasks in the near future.

The provision of gas and electricity in new towns is discussed but their utilization, on any planned basis for home and industry, is not. On the other hand, district heating is fully considered, and the Committee devotes a special appendix to it. This is of especial interest because it includes material from the as yet incomplete and unpublished report of the District Heating Sub-Committee of the Heating and Ventilation (Reconstruction) Committee of the D.S.I.R. The New

Towns Committee concludes that :

there is little doubt that district heating may be already accepted as entirely practicable in a commercial or industrial area. We think this may apply also to a domestic area with a density as low as ten houses to the acre. In our view the time has arrived for a full-scale test. District heating would confer such benefits that we recommend a trial on an adequate scale in one of the first new towns. If it is to be used it must be planned from the beginning.

News in Brief . . .

It has been a late summer, but, much as we should like to we cannot blame the weather for the lateness of this summer number. It is just another case of the general cussedness of events, and of one thing after another delaying production—until now we are afraid that receiving this *Smokeless Air*, with its bright summer jacket, will unfortunately remind readers of the summer we have borne with such literal *sang froid*.

★ One of the potentially most far-reaching activities of the Society at present is its proposals for new legislation for industrial smoke control. In the form of draft byelaws the proposals have been published, and support or criticism is being sought. The proposals and their implications will be discussed at Brighton in some detail, and we hope to consider them in the light of this discussion in our next issue. In the meantime, members may on request receive a copy of the pamphlet. (Price to non-members, 3d.)

★ Sir William Burrell has again impressed on the people of Glasgow his enlightened opinion of the quality of the city's atmosphere. Some years ago he gave to Glasgow his "priceless" collection of pictures, tapestries, and other art treasures, on condition that they were housed well outside the city. Now he has given £250,000 "towards the building of a museum for the collection without four miles of Killearn and not less than 13 miles from the Glasgow Royal Exchange," the stipulation being "for protection from the smoke laden air of the city." ★ "Fuel and the Future" is the title of the most ambitious fuel efficiency conference yet

to be arranged by the Ministry of Fuel and Power. It will be held in London from 8th to 10th October, and divided into eight sections, covering all the main industrial and the domestic aspects. There is nothing dealing specifically with smoke and its prevention, but the whole conference will be of great importance to us. Our only complaint is that the different sections are meeting at the same time, so that much of what one would wish to hear will have to be sacrificed. ★ We are very glad to hear that one of our new advertisers, Messrs. James Hodgkinson (Salford) Ltd., are pleased with the response to their first full-page announcement. They will be interested to have technical inquiries and requests for information from any reader who is concerned with steam-raising questions. ★ We believe that as soon as the supply problems of the new multi-fuel domestic appliances are solved we shall find Government policy to be what we have been urging. In reply to a question by Mr. Bossom in the House of Commons on 25th July, the Minister of Health said: "With the present stringency of supplies, the type of appliance installed must depend on what is available. The Government are taking steps to increase the production of approved appliances and I hope shortly to be in a position to advise local authorities what appliances have been approved, with particulars of cost and where they can be ordered." ★ At a health week exhibition in Edinburgh in May prominent sections were devoted to smoke abatement, and prompted much interest and many questions. A painting displayed showed an afternoon tea-party in a garden, with the sugges-

tion that it could be better enjoyed if the atmosphere were clean. ★ And apropos of eating in the smoke we may quote the following from the *Manchester City News*: "Rumour is that more people are becoming supporters of smoke abatement through eating ice-cream wafers in Ancoats. After five seconds it's so smutty as to be quite uneatable. The fastidious are also getting some idea of what the atmosphere does to their clothes."

★ The conversion of coal-burning plant to oil is in the news at the moment. What it means in practice is indicated by a statement sent to us by the Austin Motor Company. Its seven auxiliary Lancashire boilers are to be converted, and it is estimated that the amount of coal saved from the date of completion of the change-over at the end of December during the remainder of the winter will equal the monthly domestic ration for ten thousand homes. ★ The Ministry of Fuel and Power's latest Fuel Efficiency Bulletin (No. 45) is on *The Installation and Maintenance of Boiler House Instruments*. It should be of interest to many of our readers. ★ Of interest from an entirely different viewpoint is an extract from Circular 24 of the Ministry of Town and Country Planning (H.M.S.O., 1d.): "*Areas with Impure Atmospheres*: In selecting trees for planting it is important to consider the atmospheric conditions of the site and to select types likely to be successful in the conditions prevailing. In this connection attention is drawn to the fact that in some towns the reduction in atmospheric impurities in the last thirty years permits of tree planting in certain areas where it was formerly impracticable. Among the types of trees suitable are: London plane, false acacia, common ash, sycamore, lime, poplar, alder, willow, wych elm, Cornish elm, hawthorn, elder, and certain species of sorbus and prunus. Most evergreens are unsuitable, although holly, box, and yew often tolerate a smoky atmosphere." ★ The two highly important Local Acts, for Manchester and the City of London, are now on the statute book. The City has powers to require the prior approval of all new fuel-burning installations, and Manchester has made history in securing powers for the establishment of smokeless zones. We hope in our next issue to report the

actual sections of the two Acts that concern us, and to indicate the importance of the precedents that have been so set. Those attending the conference at Brighton will, however, have the opportunity of hearing representatives of the two cities, and also a Bristol speaker, where good progress is also being made, describe what has been achieved and what it is intended to do now. ★ Mr. Shinwell recently visited the works of Low Temperature Carbonization at Bolsover, where "Coalite" is manufactured. He told the workers that he regarded it as an abomination to burn coal in its raw state. "I confess," he went on, "that in the absence of the right appliances and the right materials I sometimes burn coal in the raw state, but it is all wrong. We ought to extract all the valuable by-products from the coal, and thus make it more profitable and more efficient and contribute to the health of the people. You have only got to get about and see the smoke from our chimneys to realize the effect on the health of the people in order to appreciate how useful it would be if we could turn our coal into a smokeless fuel and as a result eliminate smoke, disease and grime."

Regional and Divisional News—concluded

Greater London Advisory Council

After a period of some difficulty related to the appointment of a new secretary the Council is resuming full activity, and a meeting of its Executive Committee was held on 24th July. Mr. Clifford Ratcliff, of the Public Health Department, Westminster City Council, has been appointed Honorary Secretary. (Address: Alhambra House, 31, Charing Cross Road, W.C.2).

Scottish Division, N.S.A.S.

The Annual Meeting of the Scottish Division, for many years established as the Scottish Branch, was held on 14th May. After approval of reports Mr. Allan W. Ritchie, M.B.E., F.R.San.I., Chief Sanitary Inspector, Edinburgh, was elected President of the Division, in place of Councillor Munro, of Glasgow, who was elected an Honorary Vice-President, and to whose services over many years the new President paid tribute.

WHAT IS A HEAT PUMP?

An Interesting Smokeless Source of Heat

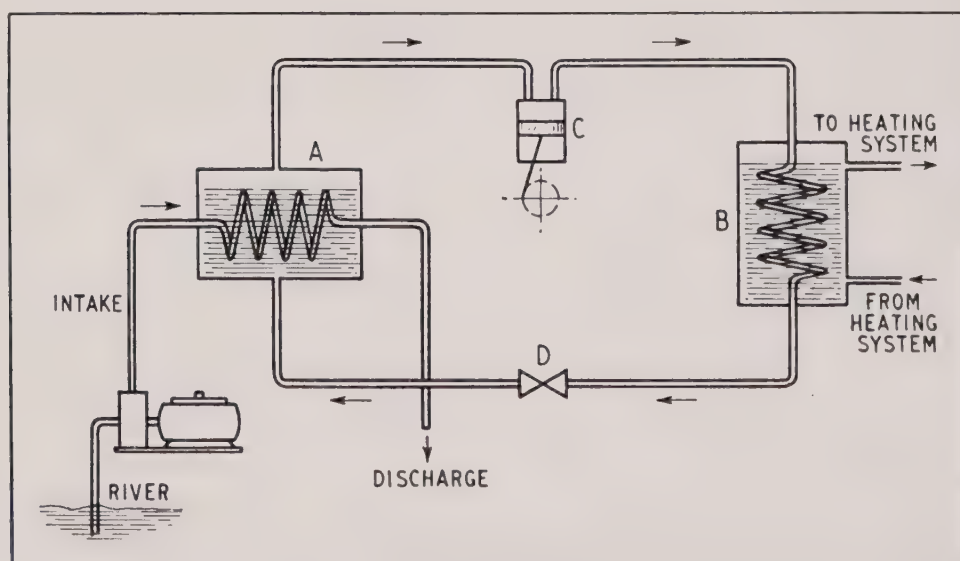
THERE has been a certain amount of discussion recently on the use of heat pumps, by means of which buildings can be warmed, rather surprisingly, by the water of a river, lake, or even—at least theoretically—by the outside air itself. As a means of saving fuel the method is particularly worth while investigating at the present time, and from the point of view of this journal it is well worthy of examination because no more smokeless source of heat than a river can be imagined. Already in this country the offices and stores of the Norwich Corporation Electricity Department are being warmed by the water of a river, and possible developments are being considered.

A heat pump has been described as a refrigerator in reverse, but this is incorrect. It *is* a refrigerator, but one in which the objective is to use, and not to discard, the heat from the substance that is cooled. To explain the principle demands first an account of what happens when a liquid vaporizes. If we apply heat to, say, cold water, the temperature rises until, at normal atmospheric pressure, it reaches the boiling point at 212 degrees F. Water at this temperature is still liquid, and to turn it into steam requires the applica-

tion of a certain further quantity of heat. The steam so produced is also at 212 degrees. In effect, as heat is applied the molecules of the liquid water become more and more agitated, but still retain that cohesion between themselves that is the condition of a liquid. To separate them into the freer condition they possess when they assume the gaseous phase requires, so to speak, an extra kick of energy. This is supplied by the further heat applied, which is used without increasing the temperature, and is called the latent heat of vaporization.

Now, boiling point depends on atmospheric pressure. The higher the pressure the greater is the amount of heat required to turn a liquid into a gas, and in the same way, if a liquid is at an appropriate temperature a reduction of pressure will cause it to boil. In so doing the latent heat required will be taken from the surroundings, which will thereby be cooled. This is the essential principle on which a refrigerator or heat pump works. Conversely, when a vapour is liquefied by pressure it gives up latent heat, which passes out and warms the surroundings.

The diagram will explain the principle as it is applied at Norwich. Water



Elementary circuit diagram of the system described.

from the river is pumped up and passes through the evaporator A, where the pipe is surrounded by a liquid refrigerant. Liquids such as ammonia, sulphur dioxide or "Freon" may be used. At Norwich sulphur dioxide, which boils at 30 degrees F. at 22 lb. per square inch absolute pressure, is used. In the closed system A B C D, C is a compressor, which when it reduces the pressure in A causes the sulphur dioxide to vaporize. The latent heat required is taken from the river water, which may enter at, say, a temperature of 40 degrees and be discharged at 38 degrees. The vapour of the sulphur dioxide, which now contains the energy taken from the water, passes through C and to a condensor, B. Here it is compressed by the further action of C, and becomes a liquid again. In doing this it gives up its latent heat, which warms the water with which the tube in the condenser is surrounded. The vapour is compressed to 150 lb. pressure per square inch, which causes its temperature to rise to 220 degrees, and to liquefy in B at 135 degrees. The water heated in B circulates in an appropriate central heating system of pipes and radiators or, preferably, panel heaters. D is an expansion valve through which the refrigerant passes, and which reduces its pressure as it travels to the evaporator for the repetition of the cycle.

It will be seen that what happens is that a little heat is taken from relatively large quantities of water, and that this is stepped-up from a lower to a higher grade by the process of refrigeration. It will also be seen that further energy has to be put into the system, for pumping up the water and for operating the compressor. Thus at Norwich coal has to be burned to produce the electricity required to work the heat pump, but how much is saved is shown by the following table :—

These figures relate to the period October 8th to November 16th, 1945, when the heat pump delivered 1,562 therms for a total expenditure of 16,381 kWh. Thus a mechanical expenditure of 560 therms (heat equivalent) provided 1,562 therms of high-grade useful heat at a temperature of 135 degrees F. This is a "reciprocal thermal efficiency" of 2.8 to 1, or 280 per cent. Improvements in design and operation indicate that the ratio will be increased to 4 : 1, or 400 per cent efficiency. The area at present warmed is 500,000 cubic feet. Under consideration is the warming of the City Hall with a 500 kW unit, and a new showrooms with a 200 kW unit, and a request has also been made for the heating of a store and printing works.

To avoid the need for individual heat pumps plans have been prepared for the installation of a large central pump at the riverside, with transmission of the heated water to the buildings requiring it—in effect a district heating scheme. Preliminary estimates indicate that the scheme would be commercially sound.

Swiss Developments

It may be asked whether the principle is new, and what other work has been done to develop it. The idea is by no means new, as its scientific basis was demonstrated by Lord Kelvin in the middle of the last century, while its technical aspects were developed by T. G. N. Haldane in a paper to the Institution of Electrical Engineers in 1930. Little or nothing has been done in this country hitherto, largely because it has been easier to burn coal and *degrade* the heat obtained than to adopt methods for *upgrading* heat, and it was generally assumed that it was commercially cheaper to do so.

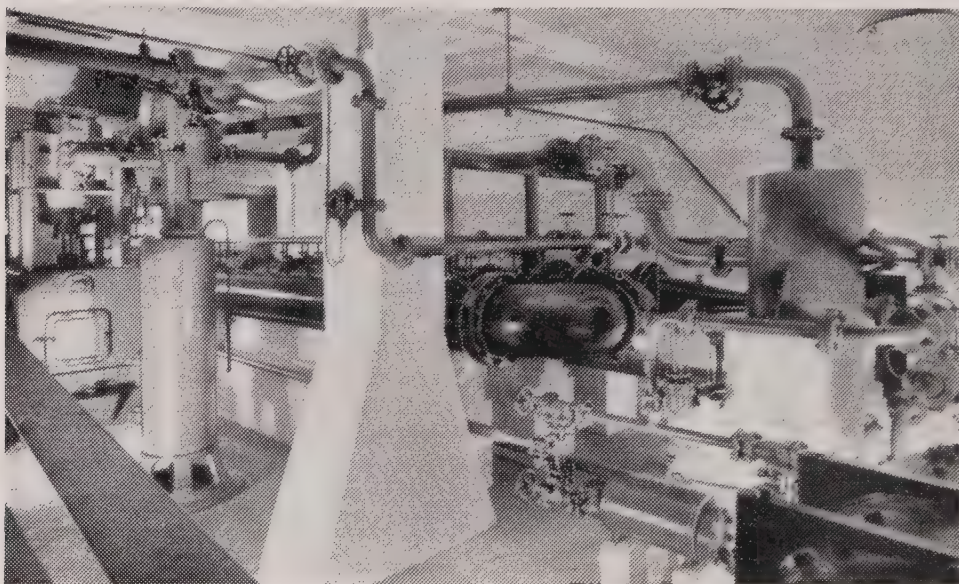
In Switzerland, however, considerable development has taken place,

<i>Method of Heating</i>	<i>Tons of Coal Used</i>	<i>Electrical Consumption kWh</i>	<i>Relative Efficiency per cent</i>
Solid fuel boilers (automatic stokers)	14	—	57.1
Resistance heaters	30.3	62,000	26.5
Heat pump	8	16,831	100

largely because of the great shortage and high price of coal during the war. Although Switzerland has ample water power for electricity generation, the flow of the rivers, being largely dependent on melting snow in the mountains, is reduced during the winter, and electricity loads that would have a high winter peak, such as direct electrical heating, have to be discouraged by suitable high tariffs. This high winter peak cost justifies the capital expenditure on heat pumps.

much higher, and the peak would of course coincide with a lower temperature of the source water, which has the effect of reducing output—just at the time that maximum output would be required. In this country, too, the wide fluctuations of winter temperature might demand supplementary heating.

There are of course many other technical and cost problems to be borne in mind in considering the possibilities of development. Although atmospheric air could be used as the heat



The pump house at Norwich, showing liquid receiver and expansion valve.

A variety of types of plant and refrigerants are used. In Zürich there are five installations, ranging in capacity from 200,000 to 18,000,000 B.Th.U.'s per hour. The largest, dating from 1944, operates in conjunction with the district heating plant at the Federal Technical Institute (the Polytechnic), and has taken over the base load heating of a group of buildings, including the Polytechnic, the University and a number of hospital buildings and flats in the vicinity. A temperature of 158 degrees F. is developed, and an annual electricity consumption of 6×10^6 kWh is required. The annual coal saving is 3,200 tons.

In most cases in Switzerland the heat pump is complementary to a fuel-fired installation which serves to give additional heat at the coldest periods. The base load met by the heat pump is about two-thirds of the peak load, and covers about 90 per cent of the total heat consumption throughout the year. To meet the total peak demand the capital cost of the heat pump would have to be

source there are a number of advantages of using a more equable source, such as the water of a river, a pool, underground lake or reservoir. Installations for individual houses do not seem, at present, to be practicable, but progress may come in the heating of commercial buildings and in the form of district heating, especially perhaps for the smaller units called block or zonal heating. It will be particularly interesting to learn, in due course, of developments and results at Norwich.

In conclusion, grateful acknowledgments are made to the Editor of *The Electrical Review* for his kind permission to use for the compilation of this article material contained in the issue of his journal, dated 3rd May, 1946, including editorial notes, an article on Swiss Installations by B. Wood, and one on the Norwich Heat Pump, by John A. Sumner, M.I.E.E., M.I.Mech.E., F.I.I.A. Thanks are also due to *The Electrical Review* for their courtesy in loaning the blocks of the two illustrations.

SMOKE PREVENTION ABSTRACTS

Acknowledgments are made, where required, to the Abstract sources indicated.

46. Does Smoke Abatement Pay?

Carter, J. H. (Heat. Pip. Air Condit., Apr., 1946, **18**, No. 4, 80-84). A recent survey of hotel owners, shopkeepers, doctors, office buildings, gardens, and all connected with building repair or renovation in St. Louis shows that since the smoke ordinance was put into effect in 1940, great improvements have been noticed in (a) cleanliness of buildings, etc., and cost of cleaning; (b) life of metal work; (c) life and health of plants; (d) reduction of interior decoration costs; (f) reduction in evidence of eye, nose and throat infections.

47. Froth Type Dust Collectors.

Powers, E. D. (Rock Products; Mine & Quarry Engng, Feb., 1946, **11**, 47-48). Dust-laden air passes through an expansion chamber, where it drops some of the larger particles into the pool below, and then goes through the spray chamber, bubbles past a liquid seal and finally passes through a bed of froth. Before leaving the apparatus, the cleaned air impinges on baffle plates which remove excess moisture.

48. Effect of Sulphur Gases in Industrial Smoke on Vegetation.

Turrell, F. M. (Citrus Leaves, 1945, **25**, No. 11, 6-7). A discussion on the effect of SO_2 on vegetation, particularly with respect to the adverse effects on citrus trees arising from increased industrialization in the Los Angeles area. (C.A.).

49. Fuel Saving in Relation to Smoke Abatement.

Hobbs, H. J. (Brit. Claywrkr, 1945, **54**, 177; Brit. Ceram. Abstr., Nov., 1945, 195). The installation of a gas-fired tunnel kiln will eliminate smoke, save fuel, and produce higher quality goods. In connection with tunnel-kiln design, systems are illustrated for the introduction of primary, secondary and tertiary air.

50. Railroads Stop Smoke with B.C.R. Jets.

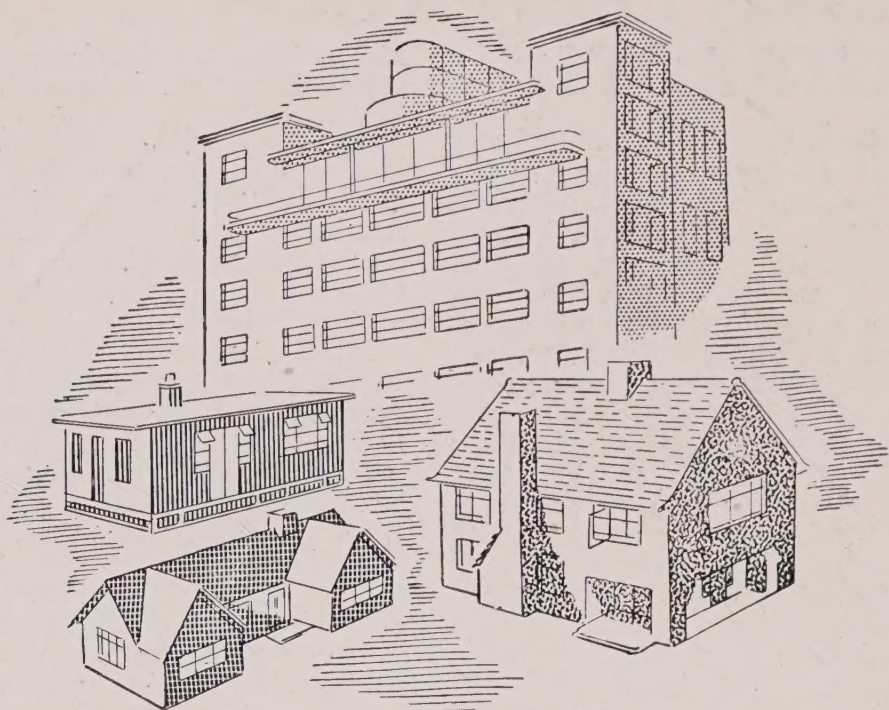
(Bituminous Coal Res., Oct.-Dec., 1945, **5**, 1-2). A demonstration of smokeless coal-burning locomotives was held in Columbus, Ohio, on Oct. 16th, at the annual meeting of the Smoke Prevention Association of America. The smoke eliminators were the products of B.C.R.

research at Batelle. The devices combine air-induction tubes fastened into the furnace wall, one-eighth inch steam nozzles for injecting outside air into the fireboxes, and all important silencers. 666 engines on 24 railroads are now equipped with the smoke eliminators.

51. Effectiveness of High Stacks in Overcoming Objectionable Concentrations of Gases at Ground Level.

Hill, G. R., Thomas, M.D., and Abersold, J. N. (Proc. 9th Ann. Meet., Industr. Hyg. Found., Pittsburgh, 15th-16th Nov., 1944; J. Industr. Hyg. Toxicol. Abstr., Oct., 1945, **27**, 163). High stacks coupled with high temperatures have largely solved the sulphur dioxide problem at many smelters. In addition, they have vastly improved operating conditions by added draught. The curves shown tend to corroborate the Bosanquet and Pearson formula of decrease of gas concentration proportional to the inverse square of stack height.

52. **Inefficiency.** Lyle, O. (Paper to Inst. Fuel; Times Tr. Engng., Apr., 1946, **58**, No. 986, 32). Stating that 80,000,000 tons of coal could be saved in this country if the urge for economy were sufficiently great, the speaker suggested the imposition of a heavy excise duty on coal, subject to appropriate drawbacks for exported products. Such duty need not increase the cost of living or of exported goods. Taking the 176,700,000 tons used for home consumption in 1944, he calculated that 40,900,000 tons were used for gas and coke, 33,440,000 tons for industrial heating, 43,400,000 tons for non-industrial and domestic purposes, and 58,960,000 tons for power, with overall efficiencies in use of 38, 23, 17, and 2.2 per cent. respectively. After an analysis of the conditions obtaining in these four groups and without assuming any techniques that are not well known, he estimated that it is possible to reduce the consumption of the first to 32,700,000 tons, in the second to 21,740,000 tons, in the third to 19,400,000 tons, and in the fourth to 21,461,000 tons, the respective overall efficiencies being increased to 47, 36, 35, and 9 per cent.



Electricity, which was the *mainpower* behind the production of munitions of war, is a prime necessity in the building and equipment of the new and better homes for present-day Britain. Electricity is no longer a luxury to be enjoyed by a few; it is the *main source* of that comfort and cleanliness to which every householder is entitled. And, in addition to being indispensable, Electricity is able to meet the hundred and one demands which indispensability entails.

For information and advice about the many new uses and greatly increased adaptability of Electricity consult your Electricity Supply Undertaking or the British Electrical Development Association, 2, Savoy Hill, London, W.C.2.

Electricity

is basic in building

